

42nd Annual Meeting
17-21 November 2010
Moab, Utah

Desert Fishes  *Council*
Consejo de los Peces del Desierto

Dedicated to the Conservation of North America's Arid Land Ecosystems

Wednesday, 17 November, 2010

- 17:00 - 21:00 Registration** Moab Valley Inn
18:00 – 21:00 Informal social Moab Valley Inn – Moab and Canyonlands rooms

Thursday, 18 November, 2010

ALL EVENTS WILL BE AT MOAB VALLEY INN – MOAB AND CANYONLANDS ROOMS

- 08:00-8:30 Welcome, Opening Remarks
08:30 - 12:00 GENERAL SESSION - 1
12:00 - 13:15 LUNCH
13:15 - 14:15 GENERAL SESSION - 2
14:15 - 14:30 BREAK
14:30 – 17:30 SPECIAL SYMPOSIUM
18:00 – 21:00 POSTER SESSION

Friday, 19 November, 2010

- 08:30 - 12:00 GENERAL SESSION - 3
12:00 - 13:15 LUNCH
13:15 – 16:30 GENERAL SESSION - 4
17:00 - 18:30 BUSINESS MEETING
19:00 - open BANQUET

Saturday, 20 November 2010

- 08:30 - 12:00 GENERAL SESSION - 5
12:00 - 13:00 LUNCH
13:00 – 15:15 GENERAL SESSION – 6
15:15 – 17:00 GENERAL SESSION – 7

Sunday, 21 November 2010

- 08:00 - 17:00 FIELD TRIPS

42nd Annual Meeting

17-21 November 2010
Moab, Utah

Thursday, 18 November, 2010

2010-11-18 08:00:00 OPENING REMARKS

GENERAL SESSION 1: Moderator—Dave Speas

2010-11-18 08:30:00 Oregon / Northern California Area Report, November 2010

Scheerer, Paul¹, Leal, Jimmy², Mauer, Alan³, Reid, Stewart⁴, Markle, Douglas⁵, Sidlauskis, Brian⁵, Miller, Stephanie¹, Divine, Paul⁶. (1-Oregon Department of Fish and Wildlife, Native Fish Investigations Project, 2-Bureau of Land Management, 3-U.S. Fish and Wildlife Service, 4-Western Fishes, 5-Oregon State University, 6-California Department of Fish and Game).

The northwestern extreme of the desert region includes several endorheic drainage subbasins in Oregon, northeastern California, and northwestern Nevada (Fort Rock, Chewaucan, Goose, Warner, Catlow, Alvord, Malheur Lakes, Coyote Lakes, and Quinn). This region supports remnant fish faunas that once inhabited extensive pluvial Pleistocene lakes. Oregon Department of Fish and Wildlife: 1) conducted distribution surveys and obtained population estimates for Interior redband trout, *Oncorhynchus mykiss*, at 273 locations in six subbasins in SE Oregon, 2) estimated relative lake abundance, operated a downstream migrant screw trap, fished larval traps, and monitored movements of PIT-tagged and radio-tagged Warner suckers, *Catostomus warnerensis*, in the Warner subbasin, 3) obtained a population estimate for Borax Lake chub, *Gila boraxobius*, in the Alvord subbasin, 4) introduced Foskett Spring speckled dace *Rhinichthys osculus ssp.*, into Dace Springs, 5) marked Foskett Spring speckled dace in the Warner subbasin for an ageing validation study, and 6) reintroduced Miller Lake lamprey into Miller Lake and Evening Creek, an historic spawning tributary. Stewart Reid, Western Fishes, continued to: 1) suppress nonnative fishes from Modoc sucker, *Catostomus microps*, habitats in Modoc County and 2) work on lamprey systematics / distribution in the Pit/Goose/Klamath basins. Drs. Doug Markle, Oregon State University (OSU), and Stewart Reid synthesized available taxonomic data and photo-documented listed or list-able Oregon desert fishes for a book-in-progress "Freshwater fishes of Oregon". Dr. Markle, David Simon, and Mark Terwilliger (OSU) studied Klamath sucker recruitment and larval retention in Upper Klamath Lake. Mark Terwilliger (OSU) conducted non-lethal ageing and ageing validation of Warner suckers and Foskett speckled dace. Daryl Bingham (BLM), Travis Neal (OSU), and Dr. Markle initiated a study of the taxonomy and distribution of Alvord and Borax Lake chub in the Alvord basin. Dr. Brian Sidlauskas and Kendra Hoekzema (OSU), in collaboration with BLM and ODFW, initiated a study of species limits and population structure in speckled daces across the arid drainages of Oregon using phylogenetics, microsatellite analysis, and morphometrics. The work will produce a systematic assessment of the taxonomic status of the threatened Foskett speckled dace, reveal patterns of genetic connectivity across the landscape, and test for the presence of cryptic species or subspecies. The California Department of Fish and Game's Heritage and Wild Trout Program: 1) conducted fish surveys for Inland redband trout and nonnative trout on 24 streams in the Goose, Upper Pit River, and Surprise Basins to describe their distribution and to collect tissue samples for genetic analysis, and 2) evaluated habitat at 16 lakes/reservoirs in the Goose, Upper Pit River, and Surprise Basins for native ranid frogs (Oregon spotted frog and northern leopard frogs). Most sites either lacked suitable physical habitat basis or contained non-native predators; no ranid frogs were observed at 10 sites.

2010-11-18 08:45:00 The Evolution of Population Studies of the Mohave Tui Chub (*Siphateles bicolor mohavensis*) at NAWS China Lake

Williams, Susan¹. (1-Desert Mountain RC&D).

A refuge population of Mohave tui chub (*Siphateles bicolor mohavensis*) was introduced into Lark Seep at Naval Air Weapons Station (NAWS) China Lake in 1971. As the population branched out into the adjacent channels, habitat maintenance and population monitoring became an ongoing requirement. Periodic population studies were performed and methods evolved over time based upon lessons learned in the field. Methodological changes included varying the numbers of traps, capturing at different times of year, times of day and with different submersion duration. New populations continue to be discovered. As the population census methodology evolves, more fish are being captured, and the confidence in the population numbers at NAWS China Lake increases.

2010-11-18 09:00:00 Warner Sucker Investigations in the Warner Basin, Oregon

Scheerer, Paul¹, Jacobs, Steve¹, Richardson, Shannon¹, Terwilliger, Mark². (1-Oregon Department of Fish and Wildlife, Native Fish Investigations Project, 2-Oregon State University, Department of Fisheries and Wildlife).

The Warner sucker (*Catostomus warnerensis*) is endemic to the Warner Valley, an endorheic subbasin of the Great Basin in southeastern Oregon and northwestern Nevada. This species was historically abundant and its historical range includes three permanent lakes, several ephemeral lakes, and three major tributary drainages. Warner sucker abundance and distribution has declined over the past century and it was federally listed as threatened in 1985 due to habitat fragmentation and threats posed by the proliferation of piscivorous non-native game fishes. In 2006-2010, we conducted investigations in the Warner basin to describe current distribution of Warner suckers, to quantify their abundance in the lakes and streams, to search for evidence of recent recruitment into the lakes, to describe size structure in the lakes and streams, to estimate sucker abundance relative to nonnative fish abundance in the lakes, to track movements of lake and stream suckers during the spawning season, and to look for evidence of larval drift. We found the Warner sucker populations in Crump and Hart Lakes were severely depressed. Recent abundance estimates in the lakes were some of the lowest on record. In addition, we found little evidence of recent recruitment of suckers to the lake populations. Sucker size distributions were dominated by large, older aged fish. Radio tracking of tagged lake fish documented losses of spawning fish in irrigation canals. We found the distribution of stream suckers to be patchy with a few

distinct areas of relatively high abundance. In 2007, we obtained a basin wide abundance estimate of ~6,900 fish in the tributary streams using a spatially-balanced random sampling design, but precision was low. In 2009, we described the distribution of Warner suckers in the Twentymile Creek subbasin and obtained a mark-recapture population estimate of ~4,600 suckers with high precision. We monitored movements of PIT-tagged and radio tagged suckers and operated a downstream migrant trap in the Twentymile Creek subbasin and found no evidence of downstream movement towards Crump Lake or losses into the irrigation ditches, yet noted large numbers of suckers moving upstream during the spawning period. After spawning, we sampled larval suckers using drift nets and dip nets, but found no evidence of larval drift. In addition, we collected tissue samples from suckers throughout the basin to examine levels of genetic variation within and among populations, to describe levels of genetic structuring among populations, to describe the relationship between stream and lake suckers, to infer life history characteristics, and to describe levels of genetic variation within an introduced population. Also, we completed a study verifying the feasibility of using pectoral rays as a non-lethal aging technique and collected pectoral rays from both lake and stream suckers to describe their age structure and age-at-maturity. Genetic analyses and the ageing study will be completed in 2011.

2010-11-18 09:15:00 **Fine-scale invertebrate community partitioning in an arid headwater stream suggests unique habitat requirements for predators**

Boersma, Kate S.¹, Bogan, Michael T.¹. (1-Oregon State University, Department of Zoology).

Predators are considered more susceptible to rapid changes in environmental variables than other trophic levels because of their high resource requirements. Predator losses destabilize community structure and can lead to irreversible changes to aquatic ecosystem functioning. Therefore, examining the existing relationship between predator distributions and abiotic variables is an important first step in order to predict aquatic community responses to climate change in streams. We sampled invertebrate communities in fragmented pools within a single arid headwater stream in southeastern Arizona in order to relate fine-scale differences in abiotic characteristics with 1) top predator presence/absence, and 2) the diversity and abundance of generalist predators. Multivariate ordination revealed that warm, deep pools with little canopy cover (WDPs) and cool, shallow pools with extensive canopy cover (CSPs) contained distinct invertebrate communities, and presence of top predators was associated with WDPs. Additionally, generalist predator diversity and abundance were significantly higher in WDPs than in CSPs. Indicator species analysis demonstrated that this WDP predator community was dominated by obligate aquatic beetles and bugs, unlike the CSPs, which were characterized by prey species with aquatic larvae and terrestrial adults. Under regional climate projections of longer, more frequent, and more intense droughts, both CSPs and WDPs are threatened by stream drying. Importantly, the loss of the WDP predatory taxa may significantly alter community structure due to cascading trophic effects. As a result, conservation efforts focused on WDPs may be required in order to maintain intact communities in arid headwater streams.

2010-11-18 09:30:00 **Genetic characterization of invading cyprinids in the Mojave River basin using diagnostic SNP and microsatellite markers**

Layman, David A.¹, Chen, Yongjiu¹, Parmenter, Steve², Hughson, Debra³, Pezold, Frank¹. (1-Texas A&M University, 2-California Dept. Fish and Game, 3-Mojave National Preserve).

The Mohave tui chub (*Siphateles bicolor mohavensis*) is a federally endangered cyprinid fish that has been completely displaced in the Mojave River by the non-native arroyo chub (*Gila orcutti*) through competition and hybridization. Hitch (*Lavinia exilicauda*), another cyprinid which recently gained access to the Mojave River through the California Aqueduct, has also demonstrated the capacity to hybridize with the arroyo chub. Methods for accurately documenting introgression and detecting the viability of hybrid offspring are needed to develop feasible recovery strategies for the Mohave tui chub. This work presents diagnostic single nucleotide polymorphism (SNP) markers as a molecular tool to distinguish the three species. SNP assay using allele-specific polymerase chain reaction (AS-PCR) and microsatellite DNA analysis take place to characterize the genetic composition of cyprinids and the extent of introgression in the river system.

2010-11-18 09:45:00 **Suppression of non-native Brown Trout and Brown Bullhead in a Modoc Sucker stream (northern California)**

Reid, Stewart B.¹. (1-Western Fishes).

The Modoc Sucker, *Catostomus microps*, a small species found in northeastern California and south-central Oregon, was federally listed as endangered in 1985. A recent conservation and status review determined that status of the species has improved substantially and the principal remaining threat to the Johnson Creek population is predation by non-native fishes, specifically the piscivorous Brown Trout, *Salmo trutta* (USFWS 2009). Brown Trout have been present in Johnson Creek since the 1930's, but have increased in number and relative abundance. The present project was initiated in 2008 to attempt eradication of Brown Trout and Brown Bullhead, *Ameiurus nebulosus*, (the only two non-native fishes present) from Johnson Creek using non-chemical, targeted removal methods (hand-net and restricted field electro-shocker) to not adversely affect Modoc Suckers. Methodology is based on experience with successful eradication of non-native Largemouth Bass from a nearby drainage also containing Modoc Suckers. There is an existing gabion barrier 0.9 mi up from the mouth of Johnson Creek that limits reinvasion, as do low summer and fall flows which dry up the lowest reach. In 2009, the first full year of the project, Brown Trout (7-29 cm) were removed from Johnson Creek, and by the end of the year only 22 Brown Trout (Year 1+) were estimated to remain in reaches containing Modoc Suckers, although higher numbers remained upstream. Rainbow Trout, *Oncorhynchus mykiss*, a native species generally found with Modoc Suckers and out-competed by the more aggressive Brown Trout, were present in all reaches, except the lowest, warmest reach (below barrier). Generally, Rainbow and Brown trout were of similar sizes, but Browns were considerably more abundant and included a few isolated larger individuals (25-36 cm). Brown Bullheads were found in moderate numbers, with a limited distribution (17 pools). Over half were removed, and only ten pools contained bullheads (mostly juveniles) at the end of the summer, with most (~65%) in just three large pools. Brown Trout were determined to spawn in Johnson Creek during October, when immigration from downstream is not possible due to dry downstream reaches. In 2010, removal of Brown Trout continued, with greater emphasis on higher reaches, which act as a source to lower reaches containing Modoc Suckers. By October 2010 only five adult Brown Trout (14-20 cm) were estimated to remain in reaches containing Modoc Suckers, with about 20 remaining in upstream reaches. There was apparently little, if any, recruitment of Brown Trout in the Modoc Sucker reaches. Rainbow Trout populations are still low but now exceed adult Brown Trout both above and below the highway. Brown Bullheads were restricted primarily to a single pool just above the barrier. The project's first two years demonstrates that removal of Brown Trout and Brown Bullhead from the Johnson Creek drainage is feasible using a low-impact methodology over a period of 3-5 years. In 2011, removal of both Brown Trout and Brown Bullhead and census of Rainbow Trout will continue, focusing on complete removal of non-natives from Modoc Sucker reaches.

2010-11-18 10:00:00 **Genetic characterization of Death Valley region speckled dace using SNP and microsatellite markers**

Furiness, Sharon J¹, Chen, Yongjiu¹, Parmenter, Steve², Pezold, Frank¹. (1-Texas A&M University Corpus Christi, 2-California Department of Fish and Game).

Speckled dace (*Rhinichthys osculus*) occur with many local or isolated forms in the major drainage systems of western North America. Potential taxonomic divergence is believed to exist between Long and Owens Valleys, and among disjunct reaches of the Amargosa River. The Owens River basin, including Long Valley and Owens Valley populations, are particularly susceptible to extinction due to their limited and diminishing habitats. Taxonomic descriptions based on genetic and morphometric data could lead to revision of their protection status. Additionally, the traditional provisional taxonomic separation of Owens and Amargosa basin populations bears examination. This study aims to use both genome-wide single nucleotide polymorphisms (SNPs) and microsatellite DNA markers to identify distinctive forms of speckled dace populations in the Owens and Amargosa River basins. Preliminary data indicate that Long Valley, Owens Valley, Oasis Valley and Amargosa Canyon speckled dace populations are genetically distinct.

2010-11-18 10:15:00 **Genetic characterization of Owens River basin tui chubs using SNP and microsatellite markers**

Gillis, Jamie¹, Chen, Yongjiu¹, Parmenter, Steve², Pezold, Frank¹. (1-Texas A&M University - Corpus Christi, 6300 Ocean Drive, Corpus Christi, TX 78412, 2-California Department of Fish and Game, 407 West Line Street, Bishop, CA 93514).

Management and recovery of the endangered Owens tui chub (*Siphateles bicolor snyderi*) faces many challenges. The primary causes for this species decline are habitat loss and introgression with Lahontan tui chub (*Siphateles bicolor obesa*). This research attempts to establish genome-wide single nucleotide polymorphism (SNP) and microsatellite markers to assess the populations of tui chub in the Owens River basin, California in order to genetically determine whether the constituents are Owens, toikona, or Lahontan-Owens hybrids. Preliminary findings from SNP and microsatellite data show that the three are distinct. Allele-Specific Polymerase Chain Reaction (AS-PCR) is used to investigate SNPs on a larger scale and delineates Owens, toikona, and Lahontan-Owens hybrids based on the frequency of alleles. Future management of tui chubs in the Owens River basin will be aided by increased taxonomic precision and introgression detection, inexpensive new protocols for specimen evaluation, and potential tools to monitor genetic status.

2010-11-18 10:30:00 **Genetic Analysis of Hybridization between Mohave tui chub and arroyo chub**

Williams, Rachel C¹, Chen, Yongjiu¹, Parmenter, Steve², Hughson, Debra³, Pezold, Frank¹. (1-College of Science and Technology, Texas A&M University – Corpus Christi, 6300 Ocean Drive, Corpus Christi, TX 78412, 2-California Department of Fish and Game, 407 West Line Street, Bishop, CA 93514, 3-Mojave National Preserve, 2701 Barstow Road, Barstow, CA 92311).

Mohave tui chub, *Siphateles bicolor mohavensis*, are no longer present in their native habitat of the Mojave River basin, California. The reintroduction and recovery of this endangered species is mandated by the U. S. Endangered Species Act, however, reintroduction has been hindered by the presence of non-native arroyo chub, *Gila orcutti*, in the river. The mass hybridization between *S. b. mohavensis* and *G. orcutti* is thought to have been the primary cause of *S. b. mohavensis* decline. Hybrids have never before been genetically identified and their genetic recombination is therefore unknown. This study aims to characterise the hybridization between the two species under experimental conditions, including 30 laboratory tanks and an outdoor pond. Samples of *S. b. mohavensis* and *G. orcutti* have been characterized; genome-wide single nucleotide polymorphism (SNP) and microsatellite DNA markers have been developed, allowing identification of both species and their hybrid offspring. The genetic composition of F1 offspring obtained from the outdoor pond experiment has also been investigated, yet no hybrids have thus far been detected. The tank hybridization experiments are currently in progress from which hybrids have been produced.

2010-11-18 10:45:00 **Unusual Dominance by Desert Pupfish in a Shallow Experimental Pond System Within the Salton Sea Basin**

Saiki, Michael K.¹, Martin, Barbara M.¹, Anderson, Thomas W.². (1-U.S. Geological Survey, Western Fisheries Research Center-Dixon Duty Station, 2-U.S. Geological Survey, Salton Sea Science Office).

In October 2006, several months after a shallow experimental pond system in the Salton Sea Basin was filled with pumped water from the Alamo River and the Salton Sea, evidence of fish life was observed in several ponds even though inlet pipes were screened in an attempt to exclude fish. In June 2007, the fish were identified as desert pupfish, *Cyprinodon macularius*. From October 2007 to November 2009, nine field surveys were conducted at roughly seasonal intervals with baited minnow traps to document fish species composition and relative abundance. The surveys yielded 3,620 fish represented by five species. Desert pupfish, the only native species encountered, was also the most numerous and comprised over 93% of the cumulative catch. Nonnative species included western mosquitofish, *Gambusia affinis*, 4.1%; sailfin molly, *Poecilia latipinna*, 2.8%; and tilapia, a mix of hybrid Mozambique tilapia, *Oreochromis mossambicus* x *O. urolepis*, and redbelly tilapia, *Tilapia zilli*,

2010-11-18 11:00:00 **Movement of Salt Creek pupfish (*Cyprinodon salinus salinus*) living in Salt Creek, Death Valley National Park, CA**

Dzul, Maria C.¹, Quist, Michael C.², Dinsmore, Stephen J.¹, Gaines, D. Bailey³, Wilson, Kevin P.³. (1-Department of Natural Resource Ecology and Management, Iowa State University, 2-U.S. Geological Survey, Idaho

Cooperative Fish and Wildlife Research Unit, Department of Fish and Wildlife Resources, University of Idaho, 3-National Park Service).

The Salt Creek pupfish, *Cyprinodon salinus salinus*, is the only aquatic vertebrate living in and endemic to Salt Creek, located on the floor of Death Valley, CA. Salt Creek pupfish were marked along a longitudinal gradient in Salt Creek to evaluate pupfish movement patterns. Minnow traps and lift nets were used to capture fish in four different habitat types (listed from upstream to downstream): headwater, wetland, channelized, and braided regions. Sampling occurred from 1 March 2010 to 18 May 2010 and consisted of three marking periods and nine recapture periods. During marking periods, captured fish greater than 31 mm in length were marked using visual implant elastomer. Fish were marked based on location of capture and marking period. In total, 4,512 fish were marked and 587 fish were recaptured. No movement was detected into or out of the headwater region. However, movement between the braided and channelized regions was fairly high; specifically 28.0% of recaptures from the channelized region were captured in the braided region, and 22.5% of fish from the braided region were captured in the channelized region. Results provide insight as to movement patterns of a little-studied, small-bodied fish inhabiting a desert stream.

2010-11-18 11:15:00 Using Variance Components to Estimate Power in a Hierarchically Nested Sampling Design: Improving Monitoring of Larval Devils Hole Pupfish

Dzul, Maria C. ¹, Dixon, Philip M. ², Quist, Michael C. ³, Dinsmore, Stephen J. ¹, Bower, Michael R. ⁴. (1-Department of Natural Resource Ecology and Management, Iowa State University, 2-Department of Statistics, Iowa State University, 3-U.S. Geological Survey, Idaho Cooperative Fish and Wildlife Research Unit, Department of Fish and Wildlife Resources, University of Idaho, 4-U.S. Forest Service, Bighorn National Forest).

Hierarchically nested sampling designs, or designs which include one or more levels of sub-samples, are common in fisheries and wildlife monitoring where replication of samples can be expensive. Variance components estimation can be used to determine how variance is partitioned among different levels of sampling, thereby helping estimate statistical power under various sampling design structures. We use the monitoring of larval Devils Hole pupfish, *Cyprinodon diabolis*, as an example to illustrate how power can be evaluated in sampling designs with multiple levels. Surveys for larval Devils Hole pupfish include three levels of sampling: surveys (2 samples per month), events (3 samples per survey), and plots (9 samples per event). The goal of this study was to determine how changing the sample size at each level (survey, event, and plot) affected the ability to detect a defined change in abundance at some level of statistical power. Using a linear mixed model, variance components were estimated for all three sampling levels (i.e., survey, event, and plot). Next, sample sizes across all levels were allowed to vary, as to represent different combinations of surveys, events, and plots. Variance was recalculated and used to calculate statistical power. Increasing sample size at the level of survey had the greatest influence on statistical power, followed by plot and event. However, since surveys are more difficult to implement, increasing the number of plots per event represents a more efficient method to increase power.

2010-11-18 11:30:00 Removal of a desert pupfish *Cyprinodon macularius* population from temporary ponds at the Salton Sea

Keeney D, Sharon ¹, Walker T, Michael ², Thomas E, Valerie ³, Crayon J, John ¹. (1-California Department of Fish and Game, Fishery Biologist, Salton Sea Program, 2-Bureau of Reclamation, Lower Colorado Region, Resources Management, Salton Sea Program Manager, 3-Bureau of Reclamation, Lower Colorado Region, Environmental Compliance Manager).

From 2006 to 2010, the Bureau of Reclamation funded the construction, operation and maintenance of an experimental 120-acre pond complex which used blended water from the Salton Sea and the Alamo River. Although steps were taken to exclude fish, desert pupfish *Cyprinodon macularius* appeared in the ponds after the first year of operation. As the ponds were scheduled for decommissioning, a multi-agency crew was organized to salvage the fish. The crew worked for three weeks, trapping, dip-netting and seining fish for transport from the ponds. As fish became more concentrated in the receding waters, daily catches went from dozens, to hundreds, to thousands of fish. By the time the operation was completed on August 5, 2010, over one million salvaged desert pupfish had been distributed to wild populations and refuge pond populations. The result of the operation has important implications for desert pupfish sampling methods and management strategies.

2010-11-18 11:45:00 Preliminary results of using stereo-video technology as a means of noninvasively measuring fish length to monitor population dynamics of the critically endangered Devils Hole pupfish, *Cyprinodon diabolis*

Gaines, D. Bailey ¹, Wilson, Kevin P. ¹, Bower, Michael R. ². (1-National Park Service, 2-U. S. Forest Service).

The use of length frequency population samples has long been used by fisheries managers as a staple tool to monitor population dynamics, assess size-class structure, identify spawning strategies and timing, and pinpoint bottlenecks at specific life stages. This basic population information, while simple to collect on more abundant species, becomes exceedingly difficult to collect when take or even handling of fish is not a responsible alternative. Additionally, photogrammetric measurements from a stereo-video camera system were found to be more accurate and precise than diver estimates. Little to no bias was evident (mean error = 0.05 mm) and the level of precision, as measured by the coefficient of variation of the differences among observed and true lengths, was 4.5%, compared to over 10% for divers. Stereo-video camera surveys should increase the consistency of long-term datasets and improve resolution to detect important differences in the length of small-bodied fishes like the Devils Hole pupfish, *Cyprinodon diabolis*. Stereo-video monitoring at Devils Hole began in March of 2010 and will continue until at least February 2011 with dives being conducted monthly. Preliminary results from the stereo-video surveys including size-class structure and the timing and frequency of cohort recruitment will be presented and discussed.

2010-11-18 12:00 – 13:15 LUNCH

GENERAL SESSION 2: Moderator—Andrew Martin

2010-11-18 13:15:00 **Genetic identification of Shoshone Spring and River Springs pupfishes using SNP and microsatellite markers**

Bautista, Roxanne¹, Gonzalez, Rocio¹, Parmenter, Steve², Chen, Yongjiu¹, Pezold, Frank¹. (1-Texas A&M University - Corpus Christi, 2-California Department of Fish and Game).

The identities of pupfish (*Cyprinodon* spp) populations in Shoshone Spring and River Springs have been a management concern. Shoshone Spring hosts a population of pupfish purported to be the endemic (*C. nevadensis shoshone*), while the nearby Amargosa River may host *C. n. amargosae*. However, a conclusive difference between the two populations has not been established. Separately, the introduced pupfish population presently found in River Springs is hypothesized to derive from both Salt Creek pupfish (*C. salinus salinus*) and Amargosa pupfish introduced in 1940. Methods for population identification and introgression detection need to be established. This work presents genome-wide single nucleotide polymorphism (SNP) and microsatellite markers to distinguish the Shoshone Spring from Amargosa River pupfish populations, and to evaluate the plausible hybridization of Amargosa River and Salt Creek pupfishes at River Springs. Preliminary results indicate that Shoshone pupfish is distinct from Amargosa pupfish. River Springs pupfish share high genetic affinity with Amargosa pupfish and significantly differ from Salt Creek pupfish.

2010-11-18 13:30:00 **Application of surface disinfectants and antibiotics to hybrid Devils Hole pupfish eggs**

Feuerbacher, Olin G.¹, Bonar, Scott A.¹, Barrett, Paul J.². (1-USGS Arizona Cooperative Fish and Wildlife Research Unit, 2-U.S. Fish and Wildlife Service).

Control of vertical transmission of pathogens is of critical importance in hatchery and laboratory settings. In addition to proper animal husbandry, various chemicals have been employed in this endeavor. Surface disinfection of eggs using formaldehyde, iodophors, hydrogen peroxide, and other chemicals has become routine in many hatcheries to control fungal, protozoan, and bacterial pathogens. Similarly, antibiotics are commonly used for the treatment of specific disease, or as a prophylactic measure in many hatchery situations, though this latter practice is often discouraged. The effects of surface disinfection of eggs, and the effects of antibiotic application either alone or in conjunction with disinfectants were explored with regard to egg hatch rate, larval and juvenile survival, and overall bacterial load in hybrid Devils Hole pupfish, *Cyprinodon diabolis* x *C. nevadensis*. We found that both formalin and iodophor disinfection of pupfish eggs led to better survival of larvae, albeit with slightly reduced hatch rates in the iodine treated eggs. Broad-spectrum antibiotics, particularly trimethoprim sulfamethoxazole and chloramphenicol were especially effective in increasing both hatch rate and juvenile survival. Combinations of formalin plus antibiotic further increased survival, while iodophor disinfection plus antibiotic treatment significantly decreased fifteen-day survival of larvae compared to untreated controls.

2010-11-18 13:45:00 **Construction of a mesocosm re-creation of Devils Hole**

Feuerbacher, Olin G.¹, Bonar, Scott A.¹, Chaudoin, Ambre L.¹, Barrett, Paul J.². (1-USGS Arizona Cooperative Fish and Wildlife Research Unit, 2-U.S. Fish and Wildlife Service).

Simulation of a fish's natural habitat in a laboratory setting can be a critical part of spawning success and important in maintaining fish health. By replicating natural environment as closely as possible, researchers may observe fish behavior in as realistic a simulation as is practical, and habitat variables may be tinkered with in ways not possible outside of the laboratory. Such reproductions are often highly automated, requiring complex and costly control equipment to operate. We describe the construction of a 4000-gallon mesocosm re-creation of Devils Hole, Nevada, that is driven primarily by biological processes and which allows for simplified control systems. This mesocosm houses hybrid Devils Hole pupfish, *Cyprinodon diabolis* x *C. nevadensis mionectes*. We discuss the abilities of an anaerobic denitrifying filter to both remove nitrate and provide calcium and trace element replenishment. We also discuss the combined use of a solar collection tube and a reverse daylight photosynthesis refugium sump to provide control over dissolved oxygen and pH buffering. The sump also provides habitat for invertebrate and algal communities, which in turn become food items for the fish in the primary tank. The growth and progression of algal species generally followed the spring to summer transition seen in Devils Hole. Invertebrate communities do not yet resemble the ratios seen in Devils Hole, but are still in a state of heavy fluctuation.

2010-11-18 14:00:00 **Using remote-monitoring technologies to assess relationships between environmental conditions and reproductive behavior in Devils Hole pupfish**

Chaudoin L, Ambre¹, Feuerbacher G, Olin¹, Bonar A, Scott¹, Barrett J, Paul². (1-USGS Arizona Cooperative Fish and Wildlife Research Unit, 2-US Fish and Wildlife Service).

Reproductive success of Devils Hole pupfish, *Cyprinodon diabolis*, has been of primary concern for some time. In particular, scientists do not know which environmental factors induce spawning in this highly endangered and notoriously difficult-to-breed species. To approach this question, over the past 12 months we have monitored spawning behavior of *C. diabolis* and concurrent environmental conditions within Devils Hole. An additional objective of this study has been to retask existing technologies to facilitate data collection. We have ultimately applied several technologies to provide minimally invasive, remote-monitoring capabilities. A solar-powered video surveillance system, incorporating above-water and underwater cameras, has provided continuous visual monitoring of the shallow spawning shelf within Devils Hole. Data-logging meters continuously record dissolved oxygen, temperature, and pH across this shelf, as well as ambient light at the water surface. Here, I present preliminary findings on associations between environmental factors and the mainly seasonal spawning activity of *C. diabolis*. I will also present some of the successes and limitations we experienced with the remote-monitoring equipment, and how these instruments might be applied as technology progresses. The final results from this study will hopefully provide information important for designing *C. diabolis* captive breeding programs. Further, our utilization of low-cost, off-the-shelf, and easily adaptable remote-monitoring equipment may be useful in future in situ studies of other species.

BREAK

“Effective conservation of desert fishes: traditional & novel approaches”

2010-11-18 14:30:00 The Desert Fishes Council and Conservation - A History

Pister, Edwin P. (Phil)¹. (1-Desert Fishes Council).

The Desert Fishes Council was established in 1969 amidst an obvious need for a means of protecting the Devils Hole pupfish (*Cyprinodon diabolis*) and Owens pupfish (*Cyprinodon radiosus*.) in an era prior to implementation of the Endangered Species Act in December, 1973. This led to the famous Devils Hole decision of the U.S. Supreme Court in June, 1976 and creation of the Owens Valley Native Fishes Sanctuary in the early 1970s. It is significant that 40 years later, and despite our best conservation efforts, both species remain on the Endangered Species list and are in many respects no more secure than they were 40 years ago. The implication here is that perhaps we are facing greater and more obscure challenges than fish conservation per se. The Council's approaches to conservation have been varied and sporadic, and the degree of our involvement highly controversial, resulting in 2003 in strong disagreement among certain members that caused them to leave the Council. All this leads to a needed discussion of "Where do we go from here?" and into the very pertinent topics underlying this session: 1) preservation, repatriation, or restoration?, 2) population or ecosystem recovery?, and 3) horizon scan for innovative and effective conservation approaches. Each of these items needs to be discussed and evaluated as a means of clarifying and directing future efforts of concerned scientists and citizens.

2010-11-18 14:45:00 Fishes of Durango, Mexico

Lambarri Biol., Christian¹. (1-Instituto de Biología UNAM).

In this paper are released some updates on the fish fauna of Durango, Mexico, considering data from previous samplings and publications mainly in the rivers Aguanaval, Caliente, El Tunal, Guatimape, La Sauceda, Nazas, Nazas-Rodeo, Poanas, San Pedro Mezquital, Santiago Bayacora, watering place La Concha, lake Santiaguillo and dam Los Naranjos. The study of the fishes of Durango consists of the elaboration of a faunal list obtaining frequency register for each species in order to evaluate their condition and threat level. This list includes species collected since 1988 until February 2010, all kept in the Instituto de Biología, UNAM, Fish Collection. Here are also considered the effects of exotic species introduction, habitat and weather alterations that have contributed to the drastic reduction of distribution and abundance of native species populations, leading them to be seriously endangered or even extinct; in addition to the damage of the ecosystem itself by occupying a niche that is not originally theirs.

En este trabajo se dan a conocer algunas actualizaciones en la ictiofauna del estado de Durango, México; considerando datos de previas publicaciones y colectas principalmente en los ríos Aguanaval, Caliente, El Tunal, Guatimape, La Sauceda, Nazas, Nazas-Rodeo, Poanas, San Pedro Mezquital, Santiago Bayacora, balneario La Concha, laguna de Santiaguillo y la presa Los Naranjos. El estudio de los peces de Durango comprendió la elaboración de un listado y la obtención de frecuencias de registro de cada una de las especies, con el fin de evaluar su estado de conservación y amenaza actuales. Este listado comprende especies colectadas desde 1988 hasta febrero de 2010 y depositadas en la Colección Nacional de Peces en el Instituto de Biología, UNAM. Se considera también el efecto de la introducción de especies exóticas que, junto con cambios en el hábitat y el clima, han contribuido a la drástica reducción de la abundancia y distribución de las especies nativas hasta estar seriamente amenazadas o incluso extinta; además del daño al mismo ecosistema al ocupar un nicho que no es originalmente suyo.

2010-11-18 15:00:00 Restoring perennial flows on an arid land river. Case study: Pecos River, New Mexico

Davenport, Stephen¹, Brooks, James¹, Myers, Marilyn², Hoagstrom Dr., Christopher³. (1-U.S. Fish & Wildlife Service, New Mexico Fish and Wildlife Conservation Office, 2-U.S. Fish & Wildlife Service, Anchorage, Alaska, Fish and Wildlife Field Office, 3-Weber State University, Department of Zoology).

In 2006, the US Fish and Wildlife Service issued a Biological Opinion on proposed water operations of the Pecos River in New Mexico by the US Bureau of Reclamation. The Biological Opinion issued a reasonable and prudent measure that operations of the Pecos River could not result in surface flow intermittence, which had occurred for consecutive years during two periods in the last 20 years. These periods of surface flow intermittence resulted in declines in abundance of native pelagic spawning cyprinids. We present an historical overview of past efforts to restore perennial flows and the recent methods used to procure supplemental waters, restore habitat and develop flexibility in water management to meet this goal. To test the success of this effort we present the results of Pecos River fish community monitoring in the years that followed the last period of river drying. Native pelagic spawning cyprinids responded most favorably to continuous surface flows. Abundance of Pecos bluntnose shiner *Notropis simus pecosensis*, Rio Grande shiner *Notropis jemezianus* and speckled chub *Macrhybopsis aestivalis* increased dramatically since 2004 the last year of surface flow intermittence.

2010-11-18 15:15:00 Comparison of aquatic habitat restoration projects at multiple scales at Ash Meadows National Wildlife Refuge: Recovery of the Ash Meadows Amargosa pupfish *Cyprinodon nevadensis mionectes*, Warm Springs pupfish, *Cyprinodon nevadensis pectoralis*, Ash Meadows speckled dace, *Rhinichthys osculus nevadensis*, and endemic aquatic invertebrate species

Andress, Robert J.¹, Gourley, Chad R.², McKelvey, Sharon³, Baldino, Cristi R.³, Weissenfluh, Darrick³, Scopettone, Gayton G.⁴. (1-Gradient Ecological, 2-Otis Bay Ecological Consultants, 3-United States Fish and Wildlife Service, 4-United States Geological Survey).

Aquatic habitat restoration associated with the recovery of endemic species including Ash Meadows Amargosa pupfish, *Cyprinodon nevadensis mionectes*, Warm Springs pupfish, *Cyprinodon nevadensis pectoralis*, Ash Meadows speckled dace, *Rhinichthys osculus nevadensis*, and several endemic aquatic invertebrate species has been completed at multiple locations and scales at Ash Meadows National Wildlife Refuge. Each restoration project required a unique approach to design and implementation due to differences in restoration goals, site history, habitat requirements, and project size. While the

recovery of federally-listed species was the overarching goal, ecosystem recovery via the restoration of hydrologic processes and native plant communities was the guiding principle behind all projects. The aquatic habitat restoration process to date has focused more on the creation of suitable and sustainable habitat than on replication of pristine habitat. However, consideration of pre-disturbance or pristine conditions, predicting the long term trajectory of created or restored habitat, and eradication of invasive species is always discussed during the planning process and incorporated during implementation when feasible. Aquatic habitat restoration projects completed to date have revealed promising indicators of success while continually informing planning and management efforts. A dramatic shift toward dominance by native fish species over non-native fish species has occurred at Kings Spring and Point of Rocks completed in 1998 and 2002 respectively. Jackrabbit Spring restoration, completed in 2007, resulted in a localized increase of *R. osculus nevadensis* abundance while ongoing monitoring indicates the increase may have been temporary or due to a change in distribution. Habitat constructed at School Spring in 2008 resulted in at least a 250% increase in *C. nevadensis pectoralis* abundance and facilitated successful repatriation of endemic aquatic invertebrate species. Results from monitoring the repatriation of *R. osculus nevadensis* in the recently restored Fairbanks Spring outflow channel (2009-2010) are preliminary but recruitment has been observed. The most critical elements common to each project were a diverse planning group and extensive onsite planning. Overall, each project has been highly successful to date with regard to species recovery and terrestrial and aquatic habitat restoration. However, success can be temporary as changes in habitat conditions or food web may result in the loss of populations that expanded immediately following restoration. Long term commitment, monitoring, and maintenance are required to continue improving restoration methods and ensure success.

2010-11-18 15:30:00 Riverscape Genetics: A Management Tool for Long-Lived Colorado River Fishes

Douglas, Michael E. ¹, Douglas, Marlis R. ¹, Hopken, Matthew W. ¹. (1-Illinois Natural History Survey, University of Illinois).

Ecological and evolutionary success of widespread, long-lived big river fishes within the intermountain West of North America is best reflected by their 'riverscape' genetics. This approach can be a management tool with which to gauge anthropogenic impacts at the ecosystem level. Here, the Bluehead Sucker (*Catostomus discobolus*; Catostomidae) can be a model organism for adaptive management in this geographically large watershed. Although distributed broadly across the Colorado and Bonneville/ Snake river basins, the Bluehead has experienced rapid, range-wide declines and is now a federal and state 'species of concern.' We genetically evaluated 1,100 individuals from 39 locations and examined the deep history of this species by sequencing two fast-evolving mitochondrial DNA genes. Three ESUs (Evolutionarily Significant Units) were identified: the Bonneville Basin/Upper Snake River, the Colorado River Basin, and the lower basin Little Colorado River. We also analyzed 16 microsatellite DNA loci in an attempt to identify basin-wide contemporary evolution. Here, 11 MUs (management units) were identified: One was consistent with the Bonneville Basin/Upper Snake River ESU while 5 were located within the Upper Colorado River basin (1 was the broadly admixed mainstem with 4 others in isolated tributaries). Three MUs were identified in the Lower Colorado River Basin: 2 with tributaries and one comprising all of Grand Canyon. Genetic diversity in Bluehead is maintained by gene flow that is concomitantly eroded within smaller, more isolated populations. A prerequisite for long-term success of this (and other) basin-wide species is metapopulation connectivity, achieved by linking more permanent 'sources' with ephemeral 'sinks' by way of tractable riverine corridors. Molecular techniques can uniquely gauge these ecological aspects and simultaneously benchmark their diminution via anthropogenic water diversions and willful introduction/ maintenance of invasive (and predatory) fishes.

2010-11-18 15:45:00 Application of Best Management Practices as a conservation tool in Texas

Bean, Megan ¹, Birdsong, Timothy ¹, Garrett, Gary ¹. (1-Texas Parks and Wildlife Department, Inland Fisheries).

More than 40% of fish and mussel taxa in Texas are listed as imperiled, a trend that is consistent nationwide. Habitat degradation is the principle contributing factor in species declines, so a conservation framework is being developed in Texas that identifies conservation best management practices (BMPs) that address specific sources of fish habitat impairments. BMPs will be made available via an interactive web-based platform with the ability to identify BMPs by ecological drainage unit, conservation objective, or land use type. Information and relevant data on drainages (e.g., number of dams, riparian vegetation communities, and riparian intactness), species occurrence, critical habitats, existing conservation priorities and initiatives, and recent and ongoing fish habitat protection and restoration projects will also be made available. This presentation will discuss planned uses of the framework in support of fish habitat protection and restoration efforts in Texas. Specifically, the presentation will highlight its utility in support of a watershed-scale fish habitat restoration initiative underway in west Texas.

2010-11-18 16:00:00 Prioritizing present and future conservation efforts for native fishes in the Lower Colorado River Basin

Strecker, Angela L. ¹, Olden, Julian D. ¹. (1-University of Washington, School of Aquatic and Fishery Sciences).

With increasingly severe losses of biodiversity and habitat fragmentation, the need for effective conservation strategies is immediate. This is of particular importance given the limited funding available for conservation; solutions need to be cost-effective. The best allocation of resources should protect the maximal number of native and endemic species, but trade-offs exist that confound conservation efforts in aquatic systems. These trade-offs may include maintaining hydrological connectivity, avoidance of non-native species, human population growth, future climate change, single-species versus community approaches, and costs involved with acquiring land for protection and/or restoration. Here, we examine the efficacy of landscape-scale tools for prioritizing conservation areas for threatened desert fishes in the Lower Colorado River Basin, with consideration of the trade-offs identified above. We also provide an overview of different landscape-scale tools available for scientists. The first step in the conservation prioritization process is to generate a basin-wide model of species distributions; this is a necessary step, as distributions of species of concern are often lacking at broad spatial scales. This was done using a combination of hydrological, topographical, land use, and climate variables. Maps of species probability of occurrence were then used as input for conservation planning efforts. We then developed a conservation priority rank of all catchments in the Lower Colorado River Basin that contrasted native species diversity with distribution models of non-native species and contemporary threats to fish species. These rankings were then compared to scenarios of human population growth and climate change over the 21st century. Our research highlights the necessity for the understanding and inclusion of the trade-offs facing conservation efforts in the basin, and the strengths and pitfalls of landscape approaches to conservation. Innovative approaches to conservation must be considered to prevent further losses of diversity of this unique fauna.

2010-11-18 16:15:00 **Interactions between desert pupfish, *Cyprinodon macularius*, and Gila topminnow *Poeciliopsis occidentalis*: implications for establishing and maintaining populations**

Robinson, Anthony, T. ¹, Ward, David, L. ¹, Timmons, Ross, J. ¹, Duncan, Doug, K. ². (1-Arizona Game and Fish Department, 2-U.S. Fish and Wildlife Service, Arizona Ecological Services Field Office).

Desert pupfish, *Cyprinodon macularius*, and Gila topminnow, *Poeciliopsis occidentalis*, inhabited similar environments and are often stocked into the same waters when implementing species conservation. Success of these stockings varied greatly and a working hypothesis developed among conservationists that desert pupfish populations were more likely to establish and persist if they were stocked first and allowed to establish before Gila topminnow were stocked. We decided to evaluate the hypothesis by examining records of past desert pupfish stockings and by conducting controlled laboratory experiments. For the wild situations, we evaluated 33 ponds where four general treatments were implemented: 1) only desert pupfish were stocked, 2) desert pupfish were stocked first and allowed to establish and then Gila topminnow were stocked, 3) both desert pupfish and Gila topminnow were stocked simultaneously, and 4) Gila topminnow were stocked first and allowed to establish before desert pupfish were stocked. Desert pupfish established populations and persisted in all nine of the ponds where they were stocked in isolation and in all six of the ponds where they were stocked first. However, only 71% of the seven desert pupfish populations remained extant where both species were stocked simultaneously, and only 50% of the six desert pupfish populations remained extant in ponds stocked first with Gila topminnow and then later with desert pupfish. The same treatments, plus one additional treatment (only Gila topminnow stocked) were implemented in laboratory experiments utilizing 2.4-m diameter tanks; each treatment was replicated four times. The laboratory experiments began by stocking 100 fish into each tank, then after one month an additional 100 fish were added to each tank, and at two months the experiment ended and all fish were counted in each tank. Desert pupfish did better when stocked alone (abundance increased in three of the four trials) or when stocked first (abundance increased in two of the four trials). Desert pupfish did worse when stocked simultaneously with topminnow (abundance decreased in three of the four trials) or when stocked after Gila topminnow had established (abundance decreased in all four trials). Gila topminnow increased in abundance in all four treatments and all four trials, but increased the least when desert pupfish were stocked first. Our results support the original hypothesis and we suggest that when attempting to establish desert pupfish populations, they should be stocked in isolation or should be stocked and allowed to establish before Gila topminnow are stocked.

2010-11-18 16:30:00 **Genetic Characterization of an Admixed Species Complex as Adaptive Management Tool**

Douglas, Marlis R. ¹, Douglas, Michael E. ¹. (1-Illinois Natural History Survey, University of Illinois).

The Colorado River Compact (1922) allocated water among 7 western states and Mexico, yet created conservation issue for a depauperate big-river fish community through its water management projects. Four species (57%) are now endangered [2 are Humpback (*Gila cypha*), and Bonytail (*G. elegans*)] while 3 (43%) are 'of concern' [one is Roundtail Chub (*G. robusta*)]. Propagation and/or translocation of these fishes from high- to low-density areas of the basin can be a tool for adaptive management, but can simultaneously be deleterious if genetically-distinct lineages are intermingled. To clarify this situation, we evaluated 4 mitochondrial DNA regions (1,869 base pairs/ 336 specimens) as a means to identify ESUs (evolutionarily significant units) among upper and lower basin *G. cypha* and *G. robusta*. Neither could be discriminated due to extensive introgressive hybridization, yet both separate from *G. elegans* at 4.8% sequence divergence. This broad admixture of two species across populations and basins is unusual given their fossil histories and distinct morphologies. To identify potential MUs (management units) in contemporaneous time, 643 specimens were genotyped across 16 microsatellite DNA loci. Here, each species was discriminated according to phenotype in all but one locale, with distinct gene pools within different regions of the basin. Six basin-wide MUs were identified for *G. cypha*. Grand Canyon sites were linked via downstream gene flow from its largest tributary, yet all were clearly separated from Upper Basin populations. Translocation/ augmentation is a risky management tool for it could confound historic admixture between Humpback and Roundtail chubs while concomitantly homogenizing those populations that remain genetically distinct. Adaptive management should instead sustain in-situ populations, with focus on (a) understanding habitat requirements, (b) maintaining flows conducive to all life history stages and (c) controlling predatory non-natives.

2010-11-18 16:45:00 **Humanity and Evolution**

Mueller, Gordon ¹. (1-Retired: USGS, BOR, NPS).

Efforts to recover razorback sucker has been ongoing for more than 3 decades with little success. Federal and state hatcheries have produced and stocked millions of razorbacks; however, reintroduction efforts have failed to build, let-alone retain wild populations. Hatchery produced razorbacks have been shown to be predator naïve and lack the survival skills and conditioning necessary to survive; a situation worsened by the practice of stocking on predator communities at carrying capacity. In spite of dismal survival, stocking continues unabated. It is well documented that natural, as well as artificially induced stressors accelerates evolutionary change. Natural selection that determines survival skills is largely absent in hatcheries which leads to domestication. Mundane rearing environments retard the process of natural selection and possibly impact inherited behaviors necessary for survival. Researchers have reported hatchery reared salmon exhibit retarded or accentuated inherited fish behavior traits; which in some cases increase aggressive behavior and reduces survival rates. The impact of hatchery production on commercial salmon stocks continues to be a key research concern in the Pacific Northwest. Similar concern for hatchery produced razorback is lacking as is an understanding of the behavioral adaptations that might also be occurring in nature. Relic populations in the Green, Yampa and Upper Colorado River; Lakes Mohave, Havasu and Roosevelt failed to adapt to human induced change and have vanished. However, a single, relic population has persisted in Lake Mead for 75 years. This oldest and last wild population has not only survived but is recruiting naturally in an environment so physically and biologically altered, it defies scientific explanation. Why there? Could behavioral adaptation within this population help explain recruitment; if so, could researchers even tell? Basin research needs to advance beyond physically based sciences to better understand issues of hatchery domestication and how inherited behavior influences survival. Management must accept the limitations, risks, and environmental ethics of stocking to merely maintain a species presence and acknowledge that hatchery razorbacks cannot survive in predator-laden habitats. Program achievement should be based on stocking survival and sustainable populations; not driven by production and stocking commitments. Conservation and recovery programs need to become more biologically accountable in terms of first securing self-sustaining communities regardless of location and minimize the ramifications of hatchery domestication. Conservation efforts should focus on those habitats and locations that have the greatest likelihood of reestablishing communities. Past research has shown that self-sustaining populations can be effectively established in off-channel, predator free habitats. An effective sanctuary plan was presented by Minckley and others (2003) nearly 8 years ago. All that remains is for agencies to find the political fortitude to implement it. Once off-channel communities are secure, the next logical step would be the most difficult task of reestablishing mainstem populations.

2010-11-18 18:00:00 Are northern crayfish, *Orconectes virilis*, resistant to CFT Legumine Fish Toxicant?

Sorensen, Jeff A.¹. (1-Arizona Game and Fish Department).

The short answer: apparently, yes. In advance of a planned chemical renovation of a small impoundment in southern Arizona, a series of bioassays were conducted on resident northern crayfish, *Orconectes virilis*, exposed to various concentrations of two commercial brands of fish toxicants (5% rotenone) to determine lethal dose thresholds. CFT Legumine Fish Toxicant was used in the first bioassay, where at the end of the test, crayfish had survived over 88 hours in rotenone solutions up to 50 ppm in concentration. In the second bioassay, Chem Fish Regular toxicant was used, and achieved 100% mortality of crayfish exposed in separate trials of 3, 5, and 10 ppm concentrations over 7 hours. While these tests were very preliminary in scope and design, it appears that crayfish were unaffected by CFT Legumine Fish Toxicant even when exposed to concentrations of rotenone that were more than ten times the maximum labeled application dose. More robust testing should be done to examine the difference in effects to crayfish between these two brands of fish toxicants. As a management consideration, planned rotenone treatments for areas with undesirable fish and invasive crayfish may be more effective at removing both nuisance species with Chem Fish Regular toxicant. In areas that have native crayfish and undesirable fish, CFT Legumine Fish Toxicant may be the preferred choice to apply where it removes fish with possibly little to no effect on the native crayfish.

2010-11-18 18:00:00 Disperse and Dispatch: Increasing and maintaining native fish populations in the Pahrangat Valley

Guadalupe, Kevin¹, Hobbs, Brian¹. (1-Nevada Department of Wildlife, Las Vegas).

A snorkel census of the last remaining occupied Pahrangat roundtail chub, *Gila robusta jordani*, habitat in the Pahrangat Valley was completely surveyed in June 2010. This was only the third complete survey since 2001. Only two fish were counted. The only hopeful sign was that these fish were young adults, likely in the 1 to 2 year old range, indicating successful reproduction must have occurred in the recent past. Fortunately, the refuge population of chub at Key Pittman Wildlife Management Area is doing very well and could serve as a seed population in the future. Approximately 90 Pahrangat Valley speckled dace, *Rhinichthys osculus velifer*, whose range has decreased significantly due to habitat loss over the past 20 years, were transferred to Maynard Spring just south of the Pahrangat National Wildlife Refuge (PNWR). Pahrangat speckled dace now occur in only three springs in the valley. During a February 2010 snorkel survey of Ash Springs, 730 White River springfish, *Crenichthys baileyi baileyi*, were counted. The population was locally robust but significant portions of habitat were dominated by shortfin mollies, *Poecilia mexicana*, and convict cichlids, *Amatitlania nigrofasciata*. A blue tilapia, *Oreochromis aureus*, was observed during this survey. This was the first and only tilapia ever observed in the Ash Springs outflow and was later removed with extreme prejudice using a spear. Removal of nonnatives from Hiko and Crystal springs has been ongoing since 2002. Over the years we have learned that the red swamp crayfish, *Procambarus clarkii*, that inhabit these two systems are likely having the most impact on the Hiko White River springfish, *C. b. grandis*, population. In 2009 we began to target the crayfish with traps that had larger mesh to allow springfish to escape. This feature allows us to set these traps for long periods, including overnight when the crayfish are most active, without undue harm to springfish. Thousands of crayfish have been removed and it appears that the *C. b. grandis* population in Hiko Spring may be responding positively. Future efforts include restocking *G. r. jordani* into historic habitats on private land and the PNWR, continuing efforts to expand the number of speckled dace populations and removing nonnative species throughout Pahrangat Valley.

2010-11-18 18:00:00 Biology Aspects of Four Mosquito Fish Species: *Gambusia senilis*, *G. hurtadoi*, *G. alvarezii*, & *G. zarski*, from Chihuahua, MÉXICO.

Valdes Gonzalez, Arcadio¹, Lira Morales, David Azael¹, Carreo-Zapiain, Ma. Teresa¹. (1-Laboratorio de Acuicultura, FCB, UANL).

The study of Chihuahua State Gambusias, *Gambusia senilis*, *G. hurtadoi*, *G. alvarezii*, & *G. zarski*, has been reviewed by several authors, especially in relation to habitat and taxonomic descriptions; however, a new species has appeared recently. This study is to deepen the understanding of these species by observation of their reproductive biology. Three pairs of each species were subjected to an identical diet, kept in 20 gallon aquariums within net suspension to hold the brood stock and avoid predation of their offspring, with temperature of 26 ± 1 °C in order to gain information on a) the number of offspring in subsequent generations, b) the size of hatchlings; c) the sex ratio of each batch; and d) growth rate. We observed that the number of fry per batch was from six to 47 and increases with subsequent events, the weight of the offspring depends on the number of siblings by spawn event and is from 0.004 to 0.02 grams, the sex ratio in *G. senilis* was biased (4 to 1) the inverse of *G. zarski* (3 to 2 ♂ ♀), while with other species the proportion remains equal; with respect to size and growth curve, *G. zarski* was the largest, followed by *G. hurtadoi*, *G. alvarezii*; the other species, perhaps due to its adaptation to thermal environment and continuous metabolic rate; and *G. senilis* with faster growth but the smallest one of riverine habitat. This study widened and enriched the information available, and demonstrated that laboratory conditions allows for observations not possible in the field of such small confined populations, with limited, different habitats and difficult access.

El estudio de las gambusias del estado de Chihuahua *G. senilis*, *alvarezii* G., *G. hurtadoi*, *G. zarski*, es un tema que ha sido revisado por varios autores, sobre todo en relación con hábitat y como caracteres taxonómicos, sin embargo ha aparecido la descripción de una especie recientemente. Con este estudio se observa su biología reproductiva, sometiendo a tres pares de cada especie en una dieta idéntica y manteniendo en acuarios de 20 galones en red suspendida esperando evitar la depredación de sus crías, en temperatura de 26 ± 1 °C para obtener información sobre a) el número de descendientes en las generaciones subsecuentes, b) el tamaño de las crías c) la proporción de sexos de cada lote, y d) la tasa de crecimiento. Demostrando que el número de alevines va de seis a 47 y aumenta con la edad; el peso varía de 0,004 a 0,02 gramos, la proporción de sexos en *G. senilis* fue desviada (4 a 1) lo inverso de *G. zarski* (3-2 ♂ ♀), mientras que en las otras especies, se mantiene igual; con respecto a la curva de tamaño y crecimiento, *G. zarski*, fue el más grande, seguido por *G. hurtadoi*, *G. alvarezii* tal vez debido a su adaptación al ambiente térmico y la tasa metabólica continua crecen más; y *G. senilis* con un crecimiento rápido pero más pequeña que las otras especies quizá por su origen riverino. Con esto se amplía y enriquece la información disponible, y se demostró que las condiciones de laboratorio permite realizar observaciones no posibles en el ámbito natural de tales poblaciones pequeñas y confinadas en hábitats limitados, conflictivos y de difícil acceso.

2010-11-18 18:00:00 **Identifying the drainage of origin of leatherside chub found in the Colorado River system**

Barrager, Adam Q.¹, Johnson, Jerald B.¹. (1-Brigham Young University, Department of Biology).

What was once considered to be a single species of leatherside chub is now recognized as two distinct species: northern leatherside chub (*Lepidomeda copei*) found in the upper Snake River drainage and southern leatherside chub (*L. aliciae*) found in the Sevier River and Utah Lake drainages of the Bonneville Basin. These species are not known to naturally occur outside of these drainages. Recently, Utah Division of Wildlife Resource personnel discovered leatherside chub in the Fremont River of the Colorado River system. This discovery is of interest given conservation concerns about both leatherside chub species. Whether this is a native population or an introduced population remains unknown. In this study we used molecular genetic markers to determine if leatherside chub in the Fremont River have been introduced, and if so, what the source of that introduction was. We found that fish from the Fremont River are southern leatherside chub and that they are most likely introduced from the Sevier River system, with strongest affinities to populations found in the East Fork of the Sevier River. This is not surprising given the proximity of the East Fork of the Sevier River to the Fremont River and the historic widespread use of leatherside chub as bait minnows for recreational fishing.

2010-11-18 18:00:00 **Underwater survey methods to identify areas used by Razorback Sucker, *Xyrauchen texanus*, below Hoover Dam to Willow Beach, Arizona**

Montony, Andrea¹, Uleplic, Caireen¹. (1-Bureau of Reclamation, Boulder City, NV).

Lake Mohave represents one of the last remaining wild populations of razorback sucker, *Xyrauchen texanus*, in the lower Colorado River. Razorback sucker monitoring extends from Willow Beach south to Davis Dam through annual round-ups, and larval collections. However, Hoover Dam to Willow Beach creates a problematic sampling area. Razorback suckers are visually identified by boat and helicopter and contacted through electrofishing yet these observations are limited by location and are depth dependent. The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Fisheries Group requested the assistance of the Lower Colorado Regional Dive Team to conduct underwater surveys identifying new areas used by razorback suckers. The survey area extended from below Hoover Dam to Willow Beach Arizona, encompassing approximately 14 river miles at depths ranging 6 to 60 feet. Methods were developed, where divers using SCUBA (self contained breathing apparatus) drifted downstream with the current recording depth, substrate, and time razorback sucker were observed. Survey data was used to create a map of the observed location's of razorback sucker. Over a hundred razorback suckers were observed during the surveys, with the majority of observations occurring within two river miles below Hoover Dam.

2010-11-18 18:00:00 **Distribution of Moapa dace and other fish in relation to wildfire at the Muddy River, southern Nevada**

Simons, Lee H.¹, Doyle, Cailin C.², Simons, Laurie S.³. (1-Nevada Fish and Wildlife Office, Las Vegas, U.S. Fish and Wildlife Service, 2-Southern Nevada Water Authority, 3-Desert National Wildlife Refuge Complex, U.S. Fish and Wildlife Service).

In July 2010, wildfire burned about 600 acres of the Warm Springs Natural Area adjacent to the Moapa Valley National Wildlife Refuge, 55 miles northeast of Las Vegas. Both the Refuge and Natural Area were established to protect the federally endangered Moapa dace (*Moapa coriacea*) and other thermophilic species endemic to the Muddy River and its warm springs emanating from the regional carbonate aquifer. Fire intensity was extreme in many areas due in particular to dense stands of exotic fan palm (*Washingtonia filifera*). Aquatic vegetation was burned or boiled in some shallow stream reaches. After the fire, charcoal was dense and mobile throughout the aquatic system. The day the fire was declared contained one shallow section of stream that previously supported Moapa dace, Moapa White River Springfish (*Crenichthys baileyi moapae*), shortfin molly (*Poecilia mexicana*), and mosquitofish (*Gambusia affinis*) was devoid of all fish. Within deeper sections of the streams, fish were generally distributed as they were before the fire. Ten days later all species except springfish had recolonized the shallow reach, but in reduced abundance. Six weeks after the fire, Moapa dace distributions were skewed strongly in favor of non-burned areas. The probable impact of water depth and fuel loading on fish survival during catastrophic wildfire will be discussed.

2010-11-18 18:00:00 **A Measure of Genetic Variability of *Meda fulgida* Based on Microsatellite Allele Frequencies**

Trujillo, Jesse D.¹, Pilger, Tyler J.¹, Turner, Tom F.¹. (1-University of New Mexico Department of Biology, Museum of Southwestern Biology).

Meda fulgida is a species of native fish now endemic to the Gila River in New Mexico, a tributary of the Colorado River. *M. fulgida* was listed by the U.S. Fish and Wildlife Service as a threatened species in 1986 after being extirpated from several rivers in New Mexico and Arizona. This study's purpose is to use microsatellite loci to determine population substructure and estimate levels of genetic variability. Nine cross-specific primer sets (developed for *Plagopterus argentissimus* a sister species of *M. fulgida*) were screened for optimal loci amplification. Seven primer sets were found to be variable and have been successful for genotyping. Microsatellite analyses show allelic richness to range from 10.73 to 15.20 and suggest that the site in the lower reaches of the Gila River have greater genetic diversity. All loci in each population sample are consistent with Hardy-Weinberg equilibrium. Pairwise F_{st} values were significant for the upper reach site suggesting that the upper site is genetically divergent from the lower two sites, but not significant for the lower sites. Geographic distance and possible habitat fragmentation may play a role in the level of genetic divergence between the three populations. This genetic information will be used to determine the degree of detrimental effects habitat fragmentation will have upon the species in relation to proposed water development.

2010-11-18 18:00:00 **A "thousand-year" flood provides long-term ephemeral habitat for "peripheral" fishes in the southern Sonoran Desert< Mexico**

Findley, Lloyd T.¹, Pérez-Tello, Mauricia¹, Montgomery, W. Linn². (1-Centro de Investigación en Alimentación y Desarrollo-Unidad Guaymas, 2-Northern Arizona University, Department of Biology).

In earliest September 2009, large and slowly moving Tropical Storm *Jimena* "parked" itself over the central Gulf of California, bringing unprecedented torrential rains to surrounding coastal regions. During 36 hours of continual strong rains *Jimena* dumped 72 cm of water on the area around Guaymas, Sonora, causing severe flooding, much damage or loss of property, and extreme scouring of normally dry water courses in canyons and arroyos on the

southern flank of the Sierra El Aguaje, just north of the seaside town of San Carlos. Based on extent of scouring and widening of arroyo beds, and the washing away of several Native American archaeological sites on former arroyo terraces, it seems appropriate to refer to *Jimena* as causing a "thousand-year" flood in the region. Scouring and collateral removal of established "riparian" vegetation was so severe as to place many normally dry or semi-wet water courses on ecological "re-set." Following the flash-flooding (and physical destruction) wrought by the storm, several such arroyos continued to conduct unprecedented surface flows to the sea for periods ranging from many days to weeks. Even after several months, when their lower courses and surface connections to the sea had desiccated, the upper stretches of some arroyos with exposed sections of bedrock became long-term, albeit eventually ephemeral, running streams. On six occasions during spring 2010, we and several colleagues hiked to one such stream in the relatively small Arroyo Baviso, tributary to the larger, more sandy, and by-then-dry Arroyo Nacapule-San Carlos. There, we superficially surveyed the arroyo's short and shallow stream and newly establishing "riparian" vegetation and collected aquatic organisms. During several weeks, the persisting surface flow and new stream-side vegetation imparted an impressive long-term aspect to the (surmised) eventual ephemeral condition of the stream. Although there are no "primary" freshwater fishes known from the surrounding area, the stream's ephemeral connection to a small seaside estuary during the storm's immediate aftermath allowed up-stream migration and temporary colonization of Arroyo Baviso by relatively large numbers of three species of notably euryhaline (often referred to a "peripheral") fishes: *Agonostomus monticola*, mountain mullet, Mugilidae; *Eleotris picta*, spotted sleeper, Eleotridae; and *Awaous transandeanus* (perhaps *A. banana*), river goby, Gobiidae (all with voucher specimens). Also vouchered were two species of langostinos which had likewise penetrated the arroyo: *Macrobrachium olfersi* and *M. sp.* (awaiting identification). Additionally, two other "peripheral" euryhaline fishes, *Dormitator latifrons* (Pacific fat sleeper, Eleotridae) and *Eucinostomus sp.* (a mojarra, Gerreidae), were photographically documented in remnant large pools in the nearby and larger Arroyo El Palmar by Michael Bogan as he searched for aquatic insects. Thus, a total of at least five species of fishes and two species of langostinos have been added (at least temporarily) to the region's formerly almost non-existent "freshwater" fauna. At last visit to Arroyo Baviso in May 2010, the shallow surface flow was decreasing, but still running; an unprecedented nine months following the storm.

2010-11-18 18:00:00 **Development and utility of exon-primed intron-crossing markers in conservation of desert fishes**

Bautista, Roxanne¹, Gillis, Jamie¹, Li, Chenhong², Parmenter, Steve³, Chen, Yongjiu¹, Pezold, Frank¹. (1-Texas A&M University-Corpus Christi, 2-Grice Marine Laboratory, 3-California Department of Fish and Game).

Nuclear DNA markers have become increasingly important in addressing conservation questions of various species; however, the availability and utility of these markers has been particularly limited for non-model organisms including desert fishes. Earlier work has attempted to use bioinformatic tools to identify a total of 210 exon-primed intron crossing (EPIC) markers and 12 primer pairs that allow amplification across a broad taxonomic range of teleost species. A considerable number of genetic markers across the genome are required in order to infer population structure and phylogenetic history. This study follows the earlier work to develop new primers for additional 24 EPICs. These primers are used to investigate a number of cyprinid and cyprinodont taxa that are endemic to deserts of North America. The intron and exon sequence variation is used to characterize intraspecific and interspecific differences between members of these taxa. Our work opens the possibility for genomic scale investigation of systematic and conservation problems in the desert fishes.

2010-11-18 18:00:00 **Observations of Rio Grande silvery minnow *Hybognathus amarus* using a fish passage structure**

Archdeacon, Thomas¹, Remshardt, Jason¹. (1-U.S. Fish and Wildlife Service; New Mexico Fish and Wildlife Conservation Office).

Fragmentation of fluvial habitats is a cause of decline of many species of fishes, particularly pelagic-spawning minnows. Construction of fish passageways might help alleviate some effects of barriers on streams. Rio Grande silvery minnow *Hybognathus amarus*, a federally endangered species, have the physiological capability of long-distance upstream migrations and in laboratory trials will use model fish passageways; however, in-stream use of fish passageways has not been documented. To determine if Rio Grande silvery minnow would use in-stream fish passageways, we implanted minnows with passive integrated transponders and a used passive scanning station to document upstream movements >10 km and use of an in-stream rock channel fish passageway on the Rio Grande, Albuquerque, New Mexico. We conclude Rio Grande silvery minnow will use appropriately constructed fish passageways. Construction of passageways might help reduce some impacts of habitat fragmentation in the middle Rio Grande on Rio Grande silvery minnow.

2010-11-18 18:00:00 **The "desert" pupfish five-year review**

Duncan K., Douglas¹. (1-USFWS).

The U.S. Endangered Species Act (ESA) [Section 4(c)(2)] requires that the status of listed species be reviewed periodically to insure that the classification as threatened or endangered is accurate. Additional recommendations on conservation measures and other actions can be made in the five-year review. We just completed the five-year review for the desert pupfish. Under the ESA, the "desert" pupfish is *Cyprinodon macularius*, and includes the "Quitobaquito" pupfish, *C. m. eremus* as the listed entities. The five-year review recommends changing the taxa covered by the act to reflect the current taxonomy and common names: desert pupfish *Cyprinodon macularius*; Rio Sonoyta pupfish *C. eremus*; and Santa Cruz pupfish *C. arcuatus* (extinct). The other main recommendation is to update the desert pupfish recovery plan to incorporate information on management units in the Salton Sink.

2010-11-18 18:00:00 **Population distribution and size structure of northern leatherside chub, *Lepidomeda copei*, in the upper Bear River drainage.**

Kelley, Sage K¹, Wesner, Jeff¹, Belk, Mark C¹. (1-Brigham Young University, Department of Biology).

Northern leatherside chub, *Lepidomeda copei*, is a threatened cyprinid native to parts of Idaho, Utah, and Wyoming. To improve methods for conservation, a better understanding of habitat use and how land use affects *L. copei* is needed. We sampled 41 major perennial tributaries to the Upper Bear River basin, and two sites in the main-stem Bear River, in southwestern WY and northeastern UT during summer 2010 to assess population distribution, length-frequency distribution, and habitat associations of *L. copei*. We sampled and measured all species in 200 m reaches of each stream using single-pass backpack electroshocking. We measured aquatic and terrestrial abiotic variables at each site to determine the in-stream habitat requirements for *L. copei* and the impact of terrestrial land use on the *L. copei* distribution. We collected *L. copei* in 15 of 43 sites. Population size varied from 1 to 261 individuals. Preliminary assessments suggest distributions may be unrelated to local land use, as large populations were found in areas with high grazing and intense land use (rotational hay fields). However, water diversions created minimal stream flows in several streams, which may contribute to further population fragmentation of this sensitive minnow. We will discuss patterns of length-frequency distributions to assess age and size structure among populations.

El Cacho ladocuero del norte, *Lepidomeda copei*, es un ciprínido amenazado native a partes de Idaho, Utah y Wyoming. Para mejorar los métodos de conservación, una mejor comprensión de como el uso del hábitat y la forma de uso del suelo afecta al *L. copei* es necesario. Se muestrearon 41 afluentes principales perennes de la cuenca superior del río Bear, y dos sitios en el Río Bear, en el suroeste de Wyoming y el noroeste de UT en el verano de 2010 para evaluar la distribución de la población, la distribución de frecuencias de tallas, y las asociaciones de hábitat de *L. copei*. Tomamos muestras y midimos todas las especies en secciones de 200 m de los corrientes con una mochila electroshock utilizando metodos de un solo paso. Se midió las variables abióticas acuáticos y terrestres en cada sitio para determinar los requerimientos de hábitat en la corriente de *L. copei*. y el impacto de la utilización del suelo en la distribución de *L. copei*. Se recogieron *L. copei* en 15 de 43 sitios. Tamaño de la población varió entre 1 y 261 individuos. Las evaluaciones preliminares indican distribuciones pueden no estar relacionadas con el uso del suelo local, ya que las grandes poblaciones se encuentran en zonas de pastoreo de alta intensidad y uso de la tierra (campos de rotación del heno). Sin embargo, las desviaciones de agua hizo flujos de corriente mínima en varias corrientes, que pueden contribuir a la fragmentación de la población más sensibles de este cacho. Vamos a discutir los patrones de las distribuciones de frecuencia de talla para valorar la edad y la estructura de tallas entre las poblaciones.

2010-11-18 18:00:00 **Is predation by invasive brown trout a threat to native fish persistence?**

Thiedi, Gary ¹, Budy, Phaedra ², Wood, Jeremiah ³, Burbank, Nora ¹. (1-Dept of Watershed Sciences, Utah State University, 2-USGS Utah Cooperative Fish and Wildlife Research Unit, Dept of Watershed Sciences, Utah State University, 3-Montana Dept. of Fish, Wildlife, and Parks).

In the USA, exotic brown trout (*Salmo trutta*) have been stocked widely, reproduce naturally, and represent a significant threat to native fishes. We examined the ecological interactions in a high-elevation stream containing exotic brown trout and native cutthroat trout (*Oncorhynchus clarkii utah*), mottled sculpin (*Cottus bairdii*), and mountain whitefish (*Prosopium williamsoni*) to determine the potential impact of an invasive trout on the native fish community. Brown trout become piscivorous at age-2 (200 mm total length) and sculpin, native trout, and whitefish represent 16.5 %, 0.1%, and 0% of their diet, respectively. Diets of brown trout overlap substantially with diets of cutthroat trout, and brown trout outcompete cutthroat trout where they occur sympatrically. Sculpin density was inversely related to trout density; where densities of trout were high, density of sculpin was low. There was no strong functional response between density of sculpin and proportion of sculpin in brown trout diets, likely because invertebrate prey are abundant in this system and piscivory may be simply opportunistic. While predation rates on native fishes appear low based on diet analyses, based on our predictions, brown trout theoretically experience little gape limitation with potential sculpin prey of all age classes, and native trout and whitefish less than 120 mm. As such, the combination of competition (firmly established in previous work), the strong allopatric distribution we observe between native and non-native fishes, and the predicted lack of substantial gape limitation clearly demonstrates that brown trout negatively impact native fishes in this system and likely elsewhere.

2010-11-18 18:00:00 **ANÁLISIS ALIMENTARIO DE LA TRUCHA YAQUI *Oncorhynchus* sp. (TELEOSTEI: Salmonidae) EN MESA TRES RÍOS, SONORA/ Food habits of the Yaqui trout *Oncorhynchus* sp. (TELEOSTEI: Salmonidae) in Mesa Tres Rios, Sonora**

Loera-Urias Sr., Leonides ¹, Varela-Romero Dr., Alejandro ¹. (1-Universidad de Sonora, Departamento de Investigaciones Científicas y Tecnológicas).

Several native forms of the genus *Oncorhynchus* occur in the Sierra Madre Occidental (SMO), only the golden Mexican trout is formally described. Unlike the San Pedro Martir *O. mykiss nelsoni* and Southwest United states trouts, *O. gilae gilae* and *O. gilae apache* which have food habits and ecology information, the Yaqui trout information is incomplete. The goal of this work is the study of the food habits of the Yaqui trout based on the analysis of stomach contents in the Mesa Tres Rios area. Sixty four specimens were collected in seven different arroyos of the region in four field trips by means of electroshocker. Captured fishes were labeled, weighed, and measured individually, and fixed in formalin 10%, and deposited at the Native Fish Collection of DICTUS. Later, extraction of the digestive system was done, and the food items were cataloged in the different taxonomic groups. In the analysis of the food habits several methods will be employed: Emptiness coefficient; index of stomach fullness; volumetric, number, frequency of occurrence, and relative importance. The trophic similarity of diets by sex will be estimated by Schoener index, and a Shannon-Wiener diversity of the prey will be estimated. The length-weight ratio and condition factor will be estimated for each native trout population. At this moment, in the analysis of stomach contents of 30 specimens the diet was entire insectivore, and was dominated by four families of aquatic insects: Hydroptilidae (Tricoptera), Chironomidae, Simuliidae (Dipera) and Crambidae (Lepidoptera).

En la Sierra Madre Occidental habitan varias formas nativas de truchas del género *Oncorhynchus*, siendo la trucha dorada mexicana, *O. chrysogaster* la Única descrita formalmente. A diferencia de las poblaciones de la Sierra San Pedro Mártir, *O. mykiss nelsoni* y el Suroeste de Estados Unidos, *O. gilae gilae* y *O. gilae apache* que se tienen estudios sobre su alimentación y aspectos ecológicos, para la trucha Yaqui no existe información sobre su historia natural. El objetivo de este trabajo es el estudio la dieta de la trucha Yaqui *Oncorhynchus* sp. basado en el análisis del contenido estomacal. El objetivo de este trabajo es determinar los hábitos alimentarios de la trucha Yaqui en el área de Mesa Tres Rios. Se recolectaron 64 especímenes en 7 diferentes arroyos de la región, en cuatro salidas de campo utilizando electropesca. Los peces recién capturados fueron etiquetados y cada ejemplar fue medido y pesado para ser fijado en formalina al 10% y depositados en la colección de Peces Nativos del DICTUS. Posteriormente se extrajeron los tubos digestivos y los organismos encontrados en ellos se separarán en diferentes grupos taxonómicos. Para el análisis de la alimentación se utilizarán el coeficiente de vacuidad, índice de llenado, los métodos volumétrico, numérico, de frecuencia de ocurrencia y de importancia relativa. La similitud trófica de las dietas por sexo será calculado con el índice de Schoener, el índice de diversidad de especies de Shannon-Wiener. Se determinará la relación peso-longitud y el factor de condición para cada población de trucha Yaqui. En el análisis estomacal de 30 ejemplares se encontró una dieta principalmente insectívora dominada por estas 4 familias: Hydroptilidae (Tricoptera), Chironomidae y Simuliidae (Dipera) y Crambidae (Lepidoptera).

2010-11-18 18:00:00 **VARIABILIDAD GENÉTICA DE LA TRUCHA YAQUI (*Oncorhynchus* sp) EN LA REGIÓN DE MESA TRES RÍOS, SONORA/Genetic variability of Yaqui trout (*Oncorhynchus* sp) in the Mesa Tres Rios area, Sonora**

Ballesteros-Cordova Sr., Carlos ¹, Varela-Romero Dr., Alejandro . (1-Universidad de Sonora, Departamento de Investigaciones Científicas y Tecnológicas).

TROUTS are fishes of the Salmonidae family, and occur in cold zones in mountain regions in the north hemisphere. There are 10 genus and almost 70 species, that reproduce in freshwater. They were spread widely around the world because of their economic relevance. In Mexico, they occur in several freshwater habitats in high mountains, and in more than 700 fish farms including in Sonora. The north of the country shows records of undescribed native trouts of genus (*Oncorhynchus*). Some molecular studies suggest the Yaqui trout as a close form of the rainbow trout, but other molecular and morphological studies of native trouts of Sierra Madre Occidental recognize the specific identity of the Yaqui trout and propose as native the trout of the Yaqui and Mayo rivers. The knowledge of the natural history of this fish still scarce, and this is the reason to study the population genetic structure and the conservation status of the Yaqui trout populations in the Mesa Tres Rios, Sonora, to improve the conservation, management, and potential aquaculture of the species in Northwest Mexico. Because cold creeks of the region are isolated by thermic barriers, we expected to find several Yaqui trout populations and they were evident by the study of the control region sequence of the mitochondrial genome. We collected 64 Yaqui trout specimens in field trips in seven arroyos in the area. Fin clips were collected and fixed in 96% ethanol for analysis in the Molecular Ecology Lab of DICTUS. DNA extraction was done with QIAamp of QIAGEN. Control Region was amplified using specific primers designed from sequences reported in the GenBank. At this moment we have complete control region sequenced from 32 specimens and several haplotypes were observed in a preliminary analysis.

Las truchas son peces de la familia Salmonidae. Habitan zonas de aguas frías en regiones montañosas del hemisferio norte. Existen alrededor de 10 géneros y cerca de 70 especies, todas desovan en agua dulce. Debido a su gran valor comercial se han propagado en diferentes partes del mundo. En México se encuentran en diversos cuerpos de agua de alta montaña y en más de 700 granjas acuícolas incluyendo Sonora. La parte Norte del país ha presentado registros de especies nativas del género *Oncorhynchus* aún no descritas formalmente por la ciencia. Algunos estudios moleculares reconocen a la trucha del río Yaqui como una forma muy cercana a la trucha arcoíris y otros estudios genéticos y morfológicos de truchas autóctonas de la Sierra Madre Occidental reconocen su identidad específica sugiriéndola como nativa de las cuencas de los ríos Yaqui y Mayo. El conocimiento sobre la historia natural de este pez sigue siendo escaso por lo que este trabajo tiene como finalidad determinar la estructura genética actual y el estado de conservación de las poblaciones de la trucha Yaqui en la región de Mesa Tres Ríos, Sonora, para así aportar conocimiento para su conservación, manejo y su potencial desarrollo acuícola de esta especie en el Noroeste de México. Debido a que los arroyos de la región de estudio se encuentran aislados por barreras térmicas se espera encontrar diferentes poblaciones de truchas habitándolos y se puede evidenciar por medio de la secuencia de la región control de su genoma mitocondrial. Se recolectaron 64 especímenes de la trucha Yaqui en cuatro salidas de campo en 7 diferentes arroyos de la región. Se tomaron muestras de aletas y se fijaron en etanol al 96% para su posterior análisis en el Laboratorio de Ecología Molecular del DICTUS. La extracción de ADN total se realizó con el kit QIAamp de QIAGEN. La región control se amplificó utilizando cebadores diseñados para a partir de secuencias reportadas en el GenBank. Hasta el momento se han obtenido las secuencias completas de la región control de 32 especímenes donde varios haplotipos se han detectado en un análisis preliminar.

2010-11-18 18:00:00 **VARIABILIDAD GENÉTICA DEL BAGRE YAQUI, (*ICTALURUS PRICEI* (PISCES: ICTALURIDAE) EN LA CUENCA DEL RÍO YAQUI, SONORA Y CHIHUAHUA/Genetic variability of the Yaqui catfish (*Ictalurus pricei* (Pisces: Ictaluridae) in the Yaqui River basin, Sonora and Chihuahua**

Trujillo-Villalba, María Irais ¹, Varela-Romero Dr., Alejandro . (1-Universidad de Sonora, Departamento de Investigaciones Científicas y Tecnológicas).

Ictalurus is the unique native genus of ictalurid in north, and central Mexico. It includes listed species for protection by the Mexican government, as well as represents economic potential because it includes commercial fishery and aquacultural species. The Yaqui catfish (*Ictalurus pricei*) is the native species recorded to Yaqui, Sonora, and Mayo, Fuerte, and Casas Grande basins in Northwest Mexico. Actually, it only occurs in the Yaqui and Fuerte rivers. Official conservation status is under special protection. Because of the impact of the introduction of exotic catfishes (*I. punctatus*, *I. furcatus*) which occurs in its natural habitats, and records of hybridization with the first mentioned exists, the status is proposed to change to endangered. Beyond actual and potential threats over the Yaqui catfish by the use of congeneric catfishes for aquaculture, the knowledge of genetic population structure is required for the conservation of this national native genome. This work will evaluate the genetic variability between Bavispe and Aros-Papigochic-Sirupa (Tutuaca) subbasins in the Yaqui basin to know the population genetic structure for conservation and potential uses in aquaculture. The genetic variability will be estimated by PCR-RFLP and analysis of the nucleotide sequences of the control region (CR) of the mitochondrial DNA in the Bavispe and Tutuaca subbasin in Sonora and Chihuahua. From 33 specimens collected in the Tutuaca river, and 11 of the Bavispe, fin clips were obtained for DNA amplifications by specific primers. For PCF-RFLP, 9 restriction endonucleases were used, and each PCR product was sequenced for the analysis of the variation. To process the genetic variation the software Arlequin, PHYLIP and PAUP will be used. Genetic variation will be estimated by nucleon diversity, homogeneity of genetic frequencies, haplotype diversity, nucleotide diversity, net nucleotide sequences divergence, and differentiation between populations (Gst). At this time, the complete sequence of the CR has been obtained from 33 samples of the Tutuaca river, and only 5 from the Bavispe river.

Ictalurus es el único género nativo de ictalúrido para el norte y centro de México, además de incluir especies enlistadas para su protección por el gobierno Mexicano y presenta potencial económico por tratarse de especies con importancia comercial, pesquera y acuicola. El bagre Yaqui (*Ictalurus pricei*) es la especie nativa para las cuencas de los ríos Yaqui, Sonora, Mayo, Fuerte y Casas Grandes en los estados de Sonora, Chihuahua y Sinaloa en el Noroeste de México. Actualmente sólo habita las cuencas de los ríos Yaqui y Fuerte. Su estatus de conservación oficial en México es sujeto a protección especial. Debido al impacto por la introducción de bagres exóticos (*I. punctatus*, *I. furcatus*) que ocupan sus hábitats naturales y del primero se han registrado eventos de hibridación se ha propuesto cambiar su estatus a en peligro de extinción. Dadas las amenazas actuales sobre el bagre Yaqui y las potenciales por el uso de bagres congéneres exóticos para acuicultura, urge conocer la estructura genética poblacional de este representante del germoplasma nacional. Este trabajo evaluará su variabilidad genética en las subcuencas de los ríos Bavispe y Aros-Papigochic-Sirupa (Tutuaca) en la cuenca del río Yaqui para conocer la estructura genética poblacional con fines de conservación y utilización acuícola potencial. La variabilidad genética se estimará por PCR-RFLP y análisis de las secuencias nucleotídicas de la región control (RC) del DNA mitocondrial de las subcuencas de los ríos Bavispe en Sonora y Tutuaca en Chihuahua. De los 33 especímenes recolectados en la subcuenca del río Tutuaca y 11 del Bavispe se tomó tejido de aleta pélvica y se extrajo el DNA para la amplificaron de la RC utilizando cebadores específicos. Para su análisis por PCR-RFLP se utilizaron 9 endonucleas de restricción y se secuenció cada

producto de PCR para el análisis de su variación. Para el procesamiento de la información se utilizarán Arlequín, PHYLIP y PAUP. La variabilidad genética se calculará por la estimación de la diversidad de nucleón y la diversidad de nucleótido, por el número de sustituciones netas de nucleótidos, la homogeneidad de las frecuencias de haplotipos, el porcentaje de divergencia de secuencias entre haplotipos y el análisis Gst entre muestras. Hasta el momento se logró obtener la región control completa de las 33 muestras pertenecientes al Río Tutuaca y de 5 de las 11 muestras del río Bavispe.

2010-11-18 18:00:00 The importance of small tributary streams to endangered fishes of the Colorado River Basin: an example from the San Rafael River, Utah

Budy, Phaedra¹, Thiede, Gary², Bottcher, Jared³, Walsworth, Tim². (1-USGS Utah Cooperative Fish and Wildlife Research Unit, Dept of Watershed Sciences, Utah State University, 2-Dept of Watershed Sciences, Utah State University, 3-USGS Western Fisheries Research Center, Klamath Falls Field Station, Oregon).

The importance of mainstem rivers and major tributaries to the endangered Colorado River fishes (Colorado pikeminnow, *Ptychocheilus lucius*, bonytail, *Gila elegans*, razorback sucker, *Xyrauchen texanus*, and humpback chub, *Gila cypha*) is well documented; conversely, the use and significance of small tributary streams is poorly understood. Historically, these fishes likely used smaller tributaries, such as the San Rafael River, to a high degree for spawning, rearing, feeding, and refuge. Currently, the proliferation of non-native species and severely altered flows, including dewatering events, may have altered tributary use by endangered fishes. In February 2008, we installed a full-duplex (134 kHz), PIT-tag detector station in the San Rafael River approximately 2 km upstream from the confluence with the Green River, an area representing a distinct habitat shift between tributary and mainstem systems. In April 2009, we installed a second PIT-tag detector station approximately 60 km upstream from the Green River confluence, and 3.5 km downstream from an impassible diversion dam. These tag-detector systems are also able to detect direction of movement. Using passive tag recaptures in the San Rafael River from 2008 to 2010, we have "recaptured" 12 Colorado pikeminnow, 13 bonytail, 6 razorback sucker, and 5 "unidentified" fish (whose PIT-tag numbers indicate they are indeed endangered species), including 1 Colorado pikeminnow detected at the uppermost detector station. Several endangered fish detections occurred on multiple occasions, often moving into and out of the San Rafael River, for a total of 47 detections since 2008. In addition to frequent use, our detection data indicate that these fishes have migrated great distances from initial tagging locations to the San Rafael River: one Colorado pikeminnow moved 282 km and one bonytail moved 333 km. Our findings, along with recent captures by researchers in similar tributary streams, demonstrate their frequent use and the importance of small tributaries and their fragile habitats to endangered fishes. Further, we draw attention to our continued inability to account for unknown tags, a full 11% of detections, an inter-agency management hurdle that must be overcome.

2010-11-18 18:00:00 Unknown waters of the Uintah Basin: evaluating the limnology, morphometry, and fish communities of seven lentic waters on the Uintah and Ouray reservation, Utah

Klobucar, Stephen¹, Budy, Phaedra², Thiede, Gary¹. (1-Utah State University, Department of Watershed Sciences, 2-Utah State University, USGS Cooperative Fish and Wildlife Research Unit).

Evaluating and understanding preexisting conditions of aquatic systems is essential to develop and implement efficient fisheries management strategies. In lentic systems, knowledge of basic limnology, morphometry, and fish community composition provides a baseline for management. The northern region of the Ute Indian Tribe's Uintah and Ouray reservation in northeastern Utah contains seven rarely studied ponds and reservoirs that support a variety of sport fisheries, but for which little baseline information is known. We used a survey grade GPS and depth sounder to create bathymetric maps and standard limnological methods to examine temperature, dissolved oxygen, light extinction, primary production, zooplankton, benthic invertebrates, and total nutrients of each system. We sampled fish communities with experimental gill nets in the littoral zone. Area and volume of the waters varied greatly from 3, respectively. These measurements varied temporally within some systems; one reservoir's volume increased by 1.85x10⁶ m³ across as little as two hours. Limnology and fish communities were also highly variable. Mid-summer secchi depths ranged among waters from 0.8 to 5.45 m while chlorophyll-a concentrations increased as much as 30-fold in one month. Cold water fish communities were depauperate including primarily rainbow trout, *Oncorhynchus mykiss*, and/or brown trout, *Salmo trutta*; these systems appear to be forage limited. Warm water communities included largemouth bass, *Micropterus salmoides*, and walleye, *Sander vitreus*, with some cold water species mixed in as well; while productive, these systems may be limited by water withdrawal and/or a large abundance of common carp, *Cyprinus carpio*. Based on our analyses, the seven waters can be classified into three general types: 1) warm water reservoirs and ponds that support complex food webs with moderate to high fish and macrophyte production 2) cold water reservoirs with moderately complex food webs and moderate fish production 3) cold water reservoirs and ponds with simple food webs, relatively low fish production and variable primary production. Our results will assist the Ute Tribe Fish and Wildlife Department in establishing an improved sampling protocol, a more cost and biologically efficient stocking program, and a better overall understanding of the waters on the Uintah and Ouray reservation. Future efforts will closely examine predator-prey interactions and limitations to fish growth within each system.

2010-11-18 18:00:00 Current status of lotic freshwater ecosystems in Jalisco and Colima, Mexico: A historical fish-based index of biotic integrity analysis.

Mercado-Silva, Norman¹, Lyons, John², Gesundheit, Pablo³. (1-School of Natural Resources and the Environment, University of Arizona, 2-University of Wisconsin Zoological Museum and Wisconsin Department of Natural Resources, 3-Instituto de Ecología, Universidad Nacional Autónoma de México).

We analyzed the current status and historical trends of environmental quality in freshwater ecosystems in Central West Mexico (Colima and Jalisco states) using a fish-based index of biotic integrity (IBI) as framework. The IBI is a bioassessment tool that analyzes compositional, structural, and functional data from a biological community to infer ecosystem health. Using data from over 230 collections made between 1955 and 2008 at more than 140 sites in lotic environments, and ecological guild information for more than 100 species we were able to describe how ecosystem health has changed through time, and define the current status of freshwater ecosystems in these two Mexican states. We detected a significant increase in the number and geographic spread of exotic species through time, and a decrease in the number and abundance of native species, especially carnivores and benthic species. The most frequently encountered exotics within the area were tilapias of the genus *Oreochromis*. These changes translated into losses of biological integrity for many sites, but other sites have maintained their environmental quality through time. Regionally, sites located near or in urban and agricultural areas observed more important declines in quality, than those located in protected and/or mountainous regions.

Utilizamos un índice biológico de integridad (IBI) con base en comunidades de peces para analizar la calidad ambiental de ambientes lóticos en el centro-oeste de México (estados de Colima y Jalisco). El IBI es una herramienta de biomonitoreo que analiza la composición, estructura y función de una comunidad de peces para hacer inferencias de la calidad ambiental. Para nuestros análisis, usamos datos de más de 230 colectas realizadas entre 1955 y 2008 en más de 140 sitios ubicados en ambientes lóticos e información ecológica para más de 100 especies de peces. Con esta información logramos describir los cambios históricos en la calidad ambiental, y evaluamos el estado actual de los ambientes lóticos. Detectamos un aumento en el número de especies no nativas presentes en los estados y su distribución geográfica a lo largo del tiempo. También observamos una disminución en el número y abundancia relativa de especies nativas a lo largo del tiempo, especialmente especies carnívoras y bénticas. Las especies no-nativas con mayor distribución fueron las tilapias del género *Oreochromis*. Los cambios históricos en las comunidades de peces reflejaron una pérdida en la integridad biológica para muchos sitios, pero otros sitios han mantenido su calidad ambiental a lo largo del tiempo. En un análisis regional, sitios ubicados en, o cerca de áreas urbanas y con actividad agrícola observaron mayores bajas en calidad ambiental que sitios ubicados en áreas protegidas y/o montañosas.

2010-11-18 18:00:00 **New record of *Gobiesox fluviatilis* Briggs & Miller (1960) (Gobiesociformes: Gobiesocidae) from Zacatecas, México**

Lozano Vilano, Ma de Lourdes¹, García Ramírez, Ma Elena¹, Contreras Balderas, Armando J.¹. (1-Universidad Autónoma de Nuevo León, Laboratorio de Ictiología).

The genus *Gobiesox* is distributed in the Pacific slope of México, Central and South America. In México there are 3 nominal species (*Gobiesox fluviatilis*, *G. juniperoserrai* and *G. mexicanus*). In a fieldtrip in 2007, using seines 3 m wide with 0.125" mesh; cast nets and Equipment of electro fishing, was obtained 5 specimens of *Gobiesox* in two localities of Río Juchipila in Zacatecas State, (La Pithaya and Moyahua). The specimens were fixed in 10% formalin and preserved in isopropyl alcohol 50%. They were deposited in the Colección Ictiológica de la Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León. The specimens showed different characteristics, like some counts, proportions and body shape, from the related species *G. fluviatilis*. It is necessary to do a deep morphologic and genetic study of the different populations in México and determine if they are *G. fluviatilis* or correspond to different species. This is the first record of genus clingfish, *Gobiesox* for the Zacatecas state.

El género *Gobiesox* se distribuye en la costa del Pacífico de México, Centro y Sudamérica. En México hay tres especies nominales (*Gobiesox fluviatilis*, *G. juniperoserrai* y *G. mexicanus*). En un viaje de campo en el 2007, donde se usaron redes chinchorros de 3m de ancho con 0.125" luz de malla; atarrayas y equipo de electropesca, se obtuvieron 5 ejemplares de *Gobiesox* en dos localidades del Río Juchipila en el estado de Zacatecas, (La Pithaya y Moyahua); los especímenes fueron fijados en formol al 10%, y preservados en alcohol isopropílico 50%, están depositados en la Colección Ictiológica de la Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León. Los ejemplares muestran diferentes características, como algunos conteos, proporciones y forma del cuerpo, con la especie relacionada *G. fluviatilis*; es necesario hacer un estudio morfológico y genético más profundo de las diferentes poblaciones en México y determinar si ellos son *G. fluviatilis* o corresponden a diferentes especies. Este es el primer registro de la cucharita, del género *Gobiesox* para el estado de Zacatecas.

2010-11-18 18:00:00 **Spatial and temporal patterns of Pecos River fish assemblage**

Bean, Megan G.¹, Bonner, Timothy H.¹, Bean, Preston T.¹. (1-Texas State University - San Marcos, Department of Biology/Aquatic Station).

We examined spatial and temporal patterns in the fish assemblage and habitat associations of fishes of the lower Pecos River, Texas at five sites seasonally between Red Bluff Reservoir and the confluence of the Pecos River and the Rio Grande at Amistad International Reservoir. A distinct dissimilarity between upstream and downstream sites' fish assemblages was observed and reflected differences among sites in relative contribution of groundwater. Upstream sites were characterized by greater conductivity and finer substrates and the fish assemblage was dominated by sheepshead minnow, *Cyprinodon variegatus*, and gulf killifish, *Cyprinodon variegatus*, rainwater killifish, *Lucania parva*, and inland silverside, *Menidia beryllina*. Downstream sites were characterized by lower conductivity, reflecting a high degree of spring influence, and larger substrates. Spring associated fishes including Proserpine shiner, *Cyprinella proserpina*, and manantial roundnose minnow, *Dionda argentosa*, were common at downstream sites and species tolerant of high conductivity were low in abundance or not present. The contribution of groundwater to stream flow appears to have a large influence on the occurrence and abundance of several species endemic to the Rio Grande drainage.

2010-11-18 18:00:00 **Rediscovery of Headwater Catfish, *Ictalurus lupus* (Ictaluridae), in a Western Gulf Slope Drainage**

Bean, Preston T.¹, Forstner, Michael R. J.², Bonner, Timothy H.¹. (1-Texas State University, Department of Biology/Aquatic Station, 2-Texas State University, Department of Biology).

Headwater catfish, *Ictalurus lupus*, inhabits clear spring-fed streams in southern New Mexico, southern Texas, and northeastern Mexico. Declines in *I. lupus* have been largely attributed to stream flow modifications, such as reduced spring flow and construction of low-head dams, and competition with channel catfish, *Ictalurus punctatus*. Hybridization between *I. lupus* and *I. punctatus* also poses a threat to *I. lupus* as habitat modifications and stocking of *I. punctatus* increased contact between the two species. Our analyses of cytochrome *b* sequences of *I. lupus* from the Frio River (n = 8), Devils River (n = 9), and Independence Creek (n = 5) indicated that a population of *I. lupus* occurs in the Frio River of the Nueces Drainage, where it was considered extirpated since 1967, and that hybridization is occurring in the Frio River and Independence Creek populations. No obvious signs of hybridization were present in the Devils River population of *I. lupus*.

2010-11-18 18:00:00 **A Preliminary Analysis of Potential Hybridization between *Gambusia nobilis* and *G. geiseri* in a reconstructed desert wetland, San Solomon Ciénega, Balmorhea State Park, Texas**

Hargrave, Chad¹. (1-Department of Biological Sciences, Sam Houston State University).

In an attempt to conserve two endangered fishes (*Cyprinodon elegans* and *Gambusia nobilis*), the Texas Parks and Wildlife Department (TPWD) restored a critical desert wetland habitat by creating the San Solomon Ciénega at Balmorhea State Park in 1996 through a cooperative effort among private, state, and federal entities. This re-creation of a desert wetland habitat within the boundaries of the original, natural ciénega provided critical habitat necessary for survival of desert wetland biota. As a result, the native fish fauna, including *Cyprinodon elegans* and *Gambusia nobilis*, have flourished, and this location

now provides a natural habitat with the largest known concentration of these taxa. However, in addition to the endangered, native taxa, several invasive species also flourish in this restored cienega. One of these invasives, *G. geiseri*, is a congener to the endangered *G. nobilis*. During seasonal monitoring of the fish populations in this cienega, we noticed individuals that superficially have both *G. nobilis* and *G. geiseri* traits. These intermediate traits may suggest hybridization between these two species. I will report on a suite of meristic and morphometric data currently being collected, and present a statistical evaluation on the potential for hybridization between these species.

2010-11-18 18:00:00 A Survey of the Native Fishes of Big Springs Creek/Lake Creek, Snake Valley, Nevada

Ambos, Aaron ¹. (1-Las Valley Water District/Southern Nevada Water Authority).

Big Springs Creek/Lake Creek is a spring fed creek system that flows for approximately 16 miles in Snake Valley (White Pine Co., Nevada, and Millard Co., Utah), and terminates in Preuss Reservoir. Despite several irrigation diversions and the presence of non-native species such as crayfish, carp, and Sacramento perch, this system has maintained an intact native fish fauna comprised of reidside shiner (*Richardsonius balteatus*), speckled dace (*Rhinichthys osculus*), Utah chub (*Gila atraria*), Utah sucker (*Catostomus ardens*), and mottled sculpin (*Cottus bairdii*). In early September 2009, as part of a biological monitoring program a three-pass depletion survey was conducted along five 100-meter reaches to estimate total fish numbers at each reach and to determine fish species distribution, composition, and relative abundance at various reaches in the creek system. Each 100 meter reach was isolated from the system using block-nets, and three passes were made with a Smith-Root LR-24 Electrofisher. The survey was repeated in early September 2010 along the same five reaches as well as a sixth reach. Speckled dace were documented at five of the six reaches and were the most abundant species where they occurred. Reidside shiner and Utah chub were also documented at varying levels of abundance at the same five reaches where speckled dace were found. Mottled sculpin were only documented at one reach, but were the second most abundant species at that reach. Utah sucker occurred in relatively low numbers at all six reaches, and were the only native fish species documented at one of the reaches (along with the non-native Sacramento perch). Total estimated fish numbers by reach were consistent between years, and ranged from 32 to 1691 fish per 100-meter reach. The reaches with direct spring flow appear to support the most abundant and diverse native fish communities.

2010-11-18 18:00:00 Degradation of Colorado River native fish habitat as a result of the complex interactions between vegetation, hydrologic changes, and geomorphology

Manners, Rebecca ¹, Schmidt, John ². (1-Intermountain Center for River Rehabilitation and Restoration, Department of Watershed Sciences, Utah State University).

Many of the streams of the Colorado River basin have narrowed and their planforms have become more simple. The result of these geomorphic changes is less available habitat for the native endemic fishes. Photographs taken in the early part of the 20th century depict wide and shallow channels. Today, the same channels are narrower with less complex habitat. The geomorphic changes have occurred, because sediment has been deposited within the formerly active channel as inset floodplains; sediment has also filled side channels and thereby transformed multi-thread reaches to single thread channels. The controlling variables, processes, and time duration over which these channels have changed are complex and are related to decadal changes in runoff, dam construction, transbasin diversions, and the invasion of non-native woody plants. In the Colorado River basin, large dams have significantly altered the hydrology and sediment loads many rivers. These changes occurred concurrently with natural climatic cycles and the spread of the invasive non-native riparian shrub tamarisk (*Tamarix* spp), that has served to increase hydraulic roughness and stabilize sediment. Feedbacks exist among water, sediment, and vegetation. As such, the interactions among these profound environmental changes have led to non-linear trajectories of channel change in the basin. We are exploring the interactions and feedbacks among tamarisk, natural climatic cycles, and dam operations in shaping the modern riverine and riparian environment along the large river's of the Colorado River basin. We are measuring channel changes and the spatial and temporal encroachment of tamarisk in three canyons in the eastern Uinta Mountains in Dinosaur National Monument. These canyons vary in their degree of tamarisk cover and hydrologic alteration: 1) the relatively unregulated Yampa River has the least tamarisk cover, 2) the highly regulated Green River upstream from the confluence with the Yampa (Lodore), and 3) a hybrid between the two, the Green River downstream from Echo Park. The channel has been progressively narrowing since at least the early 1960's in all study reaches. Channel changes are not as profound on the Yampa River as they are on the Green River, but are still considerable in certain geomorphic settings, such as areas ponded at high flows. The temporal signature and dominant flow regime at the time of tamarisk establishment along the Yampa River is specific to the geomorphic surface. For example cohorts that developed during droughts persist on gravel bars, while cohorts that developed during floods persist on high, sandy channel margin bars. In contrast, on the Green River, similar geomorphic surfaces have a wide range of tamarisk establishment ages. Spatial homogeneity of tamarisk is likely a result of the reduced flow variability. However, in all settings, cohort ages corresponded either to flood years (by-pass flows on the Green River) or drought years. These findings indicate that there are hydrologic and geomorphic controls on tamarisk establishment. These factors, along with the dynamics of tamarisk invasion, define the contemporary riverine and riparian environment.

2010-11-18 18:00:00 Effects of river drying on aquatic food web structure in the Rio Grande, New Mexico

Kraus, Jennifer S. ¹, Burdett, Ayesha S. ¹, Turner, Thomas F. ¹. (1-University of New Mexico, Museum of Southwestern Biology).

The Rio Grande that flows through Albuquerque, New Mexico is subject to harsh, dry conditions and seasonal drought. During the dry season, river habitats can be reduced to small pools where aquatic food webs are potentially affected by harsh abiotic conditions and negative biotic interactions (e.g. competition and predation). To examine effects of dry-down on food web dynamics, weekly surveys were conducted in the river channel during summer 2006. In 2009, drying pool environments were examined in experimental mesocosms (n=12), and samples were collected over a 6 week period. Isotopic ratios ($\delta^{13}\text{C}$ & $\delta^{15}\text{N}$) from algae, detritus, invertebrates and fishes in the Rio Grande in 2006 and the 2009 mesocosm experiment were used to evaluate temporal dynamics of aquatic interactions in drying pools. Stable isotope signatures changed significantly over time in the 2006 main channel data, whereas isotopic data from the 2009 mesocosm experiment showed no differences in food web structure over time, perhaps due to limited data. However, dramatic changes in species richness, abundance, and resource availability occur over very short timescales in drying aquatic habitats. The efficacy of isotopic analysis to identify key temporal changes in species interactions will be discussed.

2010-11-18 18:00:00 **Evaluation of Rearing Razorback Suckers (*Xyrauchen texanus*) in Flowing Raceways at Lake Mead Fish Hatchery**

Senger, Brandon L.¹, Sjoberg, Jon C.¹. (1-Nevada Department of Wildlife).

Razorback suckers (*Xyrauchen texanus*) are currently being raised in several hatcheries and are used for repatriation programs throughout the lower Colorado River basin. However, hatchery reared razorback suckers have shown poor post stocking survivability. Repatriated razorback suckers readily succumb to predation by nonnative fishes after being released into the wild. Increasing the target size of stocked fish has been the standard method to deter and prevent predation by gape limited predators. Recent research began investigating alternative rearing methods, via captive enrichment, that would increase overall fitness and condition of hatchery reared razorback suckers, ultimately leading to wild recruitment. The purpose of this study is to design and construct experimental raceways to evaluate rearing protocols of razorback suckers in flowing conditions. We compared swimming stamina, growth, food conversion efficiency, foraging ability, and disease treatment of fish reared in standing water, fish reared in a low and variable velocity raceway, and fish reared in a high velocity raceway to test the effects of exercise and flow conditioning on hatchery reared razorback suckers. Swimming performance, growth, and food conversion efficiency were highest among fish exposed to flowing water conditions. Furthermore, fish in the highest velocity treatment performed better in each category tested. The unexercised fish in the standing water raceway exhibited the lowest results during testing. We not only wanted to evaluate the physiological benefits from flow conditioning and exercise, but also the practicality of rearing fish at hatcheries in flowing raceways. Our results indicate that fish benefited the most from the design of the high velocity treatment. In addition to higher growth and swimming stamina, fish in the high velocity raceway had a more efficient food conversion rate. There is still limited information available on how captive enrichment aids in increasing post stocking survivability. These experimental results suggest that flow conditioned fish should have a higher overall fitness and that flow conditioning is a beneficial tool for captive rearing of razorback suckers. However, future studies need to be conducted on post release survivability of flow conditioned razorback suckers.

2010-11-18 18:00:00 **Closed Population Estimates of Humpback Chub, *Gila cypha*, in the Little Colorado River, Grand Canyon, AZ**

Van Haverbeke, David R.¹. (1-U.S. Fish and Wildlife Service).

Since 2000, a series of two-pass, closed mark-recapture efforts have been conducted in the spring and in the fall in the Little Colorado River (LCR) to track the abundance of humpback chub (HBC). Preliminary results indicate that during spring 2010 the estimated abundance of HBC ≥ 150 mm in the lower 13.57 km of the LCR was 8,099 (SE = 522). Of these fish, it was estimated that 6,311 (SE = 480) were ≥ 200 mm. These numbers indicate a continuing increase in the abundance of the spring LCR HBC spawning population. Fall results for 2010 are not yet available, however, during fall of 2009, the estimated abundance of HBC ≥ 150 mm in the lower 13.57 km of the LCR was 3,982 (SE = 480). Of these fish, it was estimated that 1,572 (182) were ≥ 200 mm. These numbers also suggest an increasing trend in the LCR population of HBC. Between 2003 and 2009, 1,643 HBC (50-131 mm TL) were translocated from the lower reaches of the LCR to above a travertine structure known as Chute Falls. Since 2006, mark-recapture efforts have been conducted in the reaches of the LCR above 13.57 km, largely in order to track the translocated HBC. Study results continue to suggest that most of the translocated fish are dispersing downriver in the LCR.

2010-11-18 18:00:00 **The *Cyprinodon julimes* case study: An experience for the development of a conservation model in Mexico**

Rodriguez-Pineda, J. Alfredo¹, De la Maza-Benignos, Mauricio¹, Lozano-Vilano, Ma. de Lourdes², García-Ramirez, Maria Elena², Vela-Valladares, Lilia³, Parra-Gallo, Haydée¹, Zapata-López, Jenny¹. (1-World Wildlife Fund-Chihuahuan Desert Program, 2-UANL, San Nicolas de los Garza, Nuevo Leon, Mexico, 3-Amigos del Pandeño, A.C., Julimes, Chihuahua, México).

As a result of the significant temporal and geographic isolation that leads to diversification, desert water bodies frequently carry fish species that are relict, endemic, rare, or restricted in distribution, sometimes to a single spring, and often living in precarious conditions. As human needs in arid areas of the world increase, and economic development demands more natural resources, competition between consumptive water uses and the environment increasingly puts pressure on both ground and surface water sources, leading to regional water stress, ecological distress, social tension, and intricacies in environmental governance. Water scarcity already impacts on large portions of Mexico, especially the arid north where annual water availability per person is only 1,750 m³ vs. the national mean of 4,416. This unbalanced distribution jeopardizes the social and economic development of approximately 60% of Mexican territory and has caused biodiversity loss and extinction of aquatic species in its largest desert ecosystem, The Chihuahuan Desert (CD). Shared by the US and Mexico, the CD is the largest desert ecosystem in North America and one of the most important desert ecoregions of the world. In the Northern CD lays the Rio Bravo/Rio Grande basin with an annual runoff of 6,177 million m³/year. One-third of this volume (2,553 million m³/year) is provided by its tributary the Conchos River. With over 1.3 million inhabitants, important Mexican cities such as Chihuahua City, Hidalgo del Parral, and Delicias are in the Conchos basin and growing rapidly due to increasing industrialization. The Conchos River Basin holds over 47 fish species, including at least 11 endemics and 10 exotics. Also, species new to science have been recently discovered and/or continue being described (e.g. *Cyprinodon julimes* De la Maza-Benignos & Vela Valladares, 2009 and *Gambusia zarskei* Meyer et al. 2010). Drying out of spring systems and wetlands along the Rio Conchos has already caused fading of environmental flows, cease of aquifer recharge, loss of biodiversity, extirpation of endemic species, desertification and social and economic distress. The permanence of desert springs and wetlands on the other hand contributes to the water security of an area, generation of environmental services, enhances regional livelihoods and triggers economic development. "El Pandeño-de-los-Pando" hot spring is home to the recently described endemic Julimes pupfish (*Cyprinodon julimes*) considered to be among the vertebrates that live at the highest temperatures on the planet. This spring is about 740 m² in size, with suitable pupfish habitat

2010-11-18 18:00:00 **The biological control of mosquito larvae populations using larvivorous fish; an eco-friendly approach**

Peralta, Matthew F.¹, Burdett, Ayesha S.¹, Turner, Thomas F.¹. (1-University of New Mexico, Museum of Southwestern Biology).

Summer drydown conditions in the Rio Grande, New Mexico, are often optimal for mosquito larvae (Family: Culicidae). This may have serious implications for human health, since it is known that mosquitoes are disease vectors for the West Nile Virus and other mosquito-borne illnesses. Several recent studies suggest that fish can provide an ecosystem service by acting as a biological control to suppress mosquito populations. Our research

investigates the role of fish as top-down controllers of mosquito populations within the Rio Grande. We used data from a mesocosm study in 2009 to evaluate abiotic and biotic factors which may influence the presence and abundance of larval mosquito populations during these seasonal conditions. Additionally, we analyzed gut content data of the fish present in the mesocosms in order to determine which species consumed the most culicid larvae. Preliminary results suggest that the presence of larval fish significantly reduced the abundance of mosquito larvae (ANOVA: p-value = 0.031). Furthermore, gut content analysis revealed native fish of the Rio Grande consumed more Culicid larvae than non-native fish. This suggests that the presence of larval fish is providing a critical ecosystem service to human health, thus making the ongoing efforts of restoration of native fishes to the Rio Grande fruitful.

Friday, 19 November, 2010

GENERAL SESSION 3: Moderator—Michael Douglas

2010-11-19 08:30:00 Lower Colorado River Basin Area Report

Voeltz, Jeremy¹. (1-U.S. Fish and Wildlife Service).

Conservation and recovery activities for native fishes in the lower Colorado River basin continued in 2010. In this presentation I will provide a short summary of activities that occurred in each 10-digit Hydrological Unit Code. Main activities focused on some of the larger recovery programs such as the Lower Colorado River Multi-Species Conservation Program, Central Arizona Project Recovery Program, and other cooperative efforts including the Stillman Lake renovation project, the Muleshoe Ecosystem Conservation program, and an American Recovery and Reinvestment Act-funded project to restore Gila trout to several streams in Arizona. Highlights for the year included the documentation of the continued recruitment of razorback sucker in Lake Mead, the translocation of humpback chub into new locations in the Grand Canyon, continued stockings of spikedace and loach minnow into Fossil Creek and other streams, and stocking of Gila trout into two new recovery areas in Arizona. Contributors include Michael Pillow (USFWS), Jeff Sorensen (AGFD), Emily Omana (NPS), Ron Kegerries (Bio-West), Zachary Shattuck (Bio-West), Mary Richardson (USFWS), Doug Duncan (USFWS), Heidi Blasius (BLM), Tim Grosch (AGFD), and Kelly Meyer (AGFD).

2010-11-19 08:45:00 Gonopodial Meristic, its meaning for taxonomy review of Chihuahuan *Gambusias*

Valdés-González, Arcadio¹, Carreón-Zapiain, Ma. Teresa¹, Lira-Morales, David Azael¹. (1-Affiliation 1 Laboratorio de Acuicultura, FCB, UANL).

Despite that Chihuahuan *Gambusia* species have been studied by several authors, the gonopodium still has elements not considered before. In this work we propose a protocol to facilitate the use of it to analyze five *Gambusia* species from Chihuahua, including a new form. The analyses and observations carried on to define each of the gonopodial structures allowed the inclusion of such structures on predesigned tables for meristic and morphology through discriminant analysis and statistics as previously described in literature. There are differences in number and shape of some structures between species although in some cases the difference was minimal. On doing so, we prove that the gonopodium can be used as a tool to complement the definition of species, including those that are very closely related such as *Gambusia alvarezi* and *G. hurtadoi*. A recommendation is to work with as many specimens as possible which can be difficult sometimes, since these are endemic species confined to small habitats and there may not be as many fully mature alpha males as statistically required, otherwise the results may not be conclusive.

A pesar de que las especies de *Gambusia* spp. de Chihuahua han sido estudiadas por varios autores, la estructura del gonopodio contiene elementos que no han sido considerados anteriormente. Con este trabajo se propone un protocolo para facilitar su estudio. Se trabajo con cinco especies de *Gambusia* spp, incluyendo una forma nueva. El análisis llevado a cabo para nombrar y definir cada una de las estructuras de los gonopodios permitió incluir dichas estructuras en tablas prediseñadas de merística y morfología. Existe diferencia en el número y forma de las estructuras entre las especies, aunque en algunos casos, dicha diferencia fuera mínima. Con esto se comprueba que el gonopodio puede ser utilizado como una herramienta complementaria para la definición de especies, incluyendo aquellas que son muy cercanas tales como *G. alvarezi* y *G. hurtadoi*. Se recomienda trabajar con el mayor número posible de machos alfa, lo cual puede resultar difícil pues se trata de poblaciones endémicas confinadas a pequeños espacios donde pueda no existir la cantidad requerida para el análisis estadístico, y los resultados podrían no ser concluyentes.

2010-11-19 09:00:00 Post-stocking mortality and movement of telemetered bonytail *Gila elegans* in Lake Havasu

Adelsberger, Christine M.¹, Karam, Abraham P.¹, Marsh, Paul C.¹. (1-Marsh & Associates, LLC.).

Perseverance of bonytail *Gila elegans* in the Colorado River Basin relies entirely on stocking and Lake Havasu is one of few locations where they are occasionally contacted. Little information is available concerning the basic ecology of this critically endangered species and a limited number of telemetry studies have been conducted. Only one bonytail telemetry study has previously occurred in Lake Havasu and its results indicated a majority of telemetered fish dispersed near shore or in coves. Unfortunately, high mortality of tagged fish prevented conclusions from being drawn about seasonal dispersal or habitat preferences of bonytail in that system. This study examined post-stocking dispersal and mortality of bonytail stocked in Lake Havasu. In April 2010, 20 bonytail were implanted with 90-day acoustic transmitters and tracked actively by boat and passively with submersible ultrasonic receivers for three months. Fish dispersed between 2.6 km downstream and 27.1 km upstream of the stocking location, and were found between 1 and 503 meters from shore during active tracking events, averaging 129 meters from shore. By the end of the study, one mortality was confirmed using SCUBA. A tag retention study conducted at Dexter National Fish Hatchery and Technology Center from July-October 2010 confirmed our surgical techniques did not affect the health or growth of implanted fish and suggested that a larger, 6-month tag may be used for future bonytail telemetry studies.

2010-11-19 09:15:00 **Genetic Variation is the Spice of Life. Microsatellite Marker Analysis of Lake Mohave Razorback Sucker**

Saltzgeber, Melody J. ¹, Marsh, Paul C. ², Dowling, Tom E. ¹. (1-Arizona State University, School of Life Sciences, 2-Marsh and Associates).

The endangered Razorback Sucker (*Xyrauchen texanus*) is indigenous to the Colorado River system. The largest aggregations of Razorback Suckers are currently in Lake Mohave; however, there has not been natural recruitment in Mohave for many years mostly due to predation from a suite of non-native fish. The current conservation protocol is to collect the wild razorback larvae from the lake, and rear them until they are large enough reduce the frequency of predation. Previous studies using mitochondrial DNA (mtDNA) have shown that genetic variation is maintained using this strategy, with no differences in levels of variation and allele frequency among larvae, repatriated individuals, and wild adults over the last 13 years. Because mtDNA is maternally inherited, previous studies did not examine the male component of the system; therefore, we characterized highly polymorphic nuclear DNA markers (15 microsatellite markers) to assess the joint male-female contribution to larval production. This approach corroborated results provided by analyses of mtDNA, with levels of microsatellite variation maintained across years. This indicates the management strategy is not impacted by behavior of males and it reliably maintains genetic variation.

2010-11-19 09:45:00 **The Use of Remote Sensing PIT Scanners for Monitoring Habitat Preferences Among Razorback Sucker at Imperial Ponds NWR**

Fencil, Jane S ¹, Kesner, Brian ¹, Ley, Guillermo ¹, Marsh, Paul C ¹. (1-Marsh & Associates, LLC).

In April 2005, The Lower Colorado River Multi Species Conservation Plan (LCR-MSCP) was created to balance the use of water resources with conservation of native fishes, as a response to the continuing decline of native fish in the basin. A component of the plan was to develop off-channel locations focused on maintaining razorback sucker *Xyrauchen texanus* genetic stock. In 2007, six ponds were established at Imperial National Wildlife Refuge (INWR). In an effort to monitor razorback sucker habitat use, remote PIT (Passive Integrated Transponder) tag scanners were deployed throughout stocked ponds beginning in February 2009 on a monthly basis. The use of remote scanners has been integral in collecting data used to analyze habitat preferences and movement patterns throughout the year. Each month, four habitat types were randomly sampled for at least three consecutive days in each pond. Habitats were defined by specific features included in the design of the ponds and delineated as: hummock, rip-rap shore, mud shore, and open water. From February 2009 to September 2010, 3,476 PIT tag contacts were recorded at INWR. Habitat preferences varied among ponds and throughout the year. The ability to gather month-to-month movement and habitat use data at the individual and population level is unsurpassed by similar techniques such as camera trapping and fixed telemetry.

2010-11-19 10:00:00 **Advances in fish sampling: An overview of techniques and standardization**

Bonar, Scott A. ¹. (1-USGS Arizona Cooperative Fish and Wildlife Research Unit, University of Arizona).

Advances in fisheries sampling are escalating to address the increased needs for communication among fisheries professionals; increasingly accurate and precise data; and larger regional or global scale assessments. Environmental DNA analyses, and new videographic, hydroacoustic, and electrofishing approaches have all been made possible due to progress in technology. Communication among fisheries scientists has been aided by the publication of the American Fisheries Society *Standard Methods for Sampling North American Freshwater Fishes*, which was developed through a collaboration of 284 biologists from 107 state, federal, local and private agencies and organizations. This work recommends standard methods on a continental scale improving the ability to compare data among agencies, regions or time scales. Current research on standard methods focuses on calibration of local techniques to the North American methods, development of efficiency models for active techniques such as electrofishing, and development of web-based electronic means to compile and compare data collected from standardized monitoring efforts. An overview of current research on fisheries sampling techniques and how standard methods are being incorporated into North American fisheries management illustrates the importance of advancements in technology and communication among biologists when conserving the continent's fish populations.

2010-11-19 10:15:00 **A Systematic Revision of the *Herichthys* Genus, with One New Genus and Three New Species Endemic to the Panuco-Tamesí River Basin, Mexico**

De la Maza-Benignos, Mauricio ¹, Lozano-Vilano, Ma. de Lourdes ². (1-World Wildlife Fund-Chihuahuan Desert Program, 2-UANL, San Nicolas de los Garza, Nuevo Leon, Mexico).

The authors describe a new genus along with three new species of Cichlids from the Panuco River Basin, based on chromatic, morphometric and meristic characters, including number of teeth along the posterior margin and median axis of the occlusal surface of the lower pharyngeal plate. Classification Discriminant Analysis for 294 specimens pertaining to *Herichthys* and 96 pertaining to the new genus, produced a correct classification rate of 0.968 for the new genus and of 0.986 for *Herichthys* giving an overall correct classification rate of 0.982 based on 42 morphometric measurements, supporting the separation between the two superior taxa. The analysis is in accord with the split *sensu* Stawikowski and Werner, (1998) of *Herichthys* in two groups: the *H. cyanoguttatus* and the *H. bartoni* groups; and supported on Cytochrome b gene comparisons through molecular analysis by Hulsey et al. (2003) and Concheiro-Pérez et al. (2006) which set the monophyletic lineages that conform the new genus and its phylogenetic branch under a crown group, as sister to *Herichthys* with a lowest likelihood score of 0.76 and 1 respectively. Our analysis concurs with the validity of "*Herichthys*" *steindachneri* (Jordan and Snyder, 1900) and supports "*Herichthys*" *pantostictus* (Taylor and Miller, 1983) as a distinct species. However, our findings are in discord with Taylor and Miller's (1983) interpretations of *H. labridens* and *H. pantostictus*. Our results show that *H. labridens sensu* Taylor and Miller, (1983) is comprised of separate diagnosable allopatric lineages conforming a composite of four distinct species, and that *H. pantostictus* is composed of a number of parapatric populations inhabiting the lower Panuco and the Tamesí river basins, as well as tributaries to the adjacent Tamiahua and San Andres lagoon systems. *H. pantostictus* displays extensive geographic variation in morphometric and meristic characters, as well as breeding coloration associated with lotic or lentic conditions, as well as substrate and diet composition. While lagoon populations are "entirely dotted", trait which according to Taylor and Miller, 1983, is key to distinguish from *H. labridens*, many river populations and individuals are not. It is plausible that the geographic distributional pattern of the trait drove Taylor and Miller, (1983) to erroneously conclude that an "entirely dotted pattern" is key to separating *H. pantostictus* from *H. labridens* and that the Rio Sabinas, NE of Gómez Farías and Rancho Pico de Oro, tributary to the Río Guayalejo, populations were sympatric or parapatric with *H. labridens*. New species from the "El Salto" river in San Luis Potosí characterized by Dorsal fin XV-XVI, 10 – 11; Anal fin V, 8-9; from Rio Tamasopo in San Luis Potosí, characterized by 10-11 scales between the lateral line and anal fin origin, a very long and shallow caudal peduncle 5.4-6.3 and 6.7-7.6 in SL; and from Laguna Azteca, Hidalgo, Mexico characterized by very small eyes 4.4-6.3 in HL, dorsal fin base 2.4-2.6 and pectoral fin base 2.9-3.2 both in SL; and

a slender lower pharyngeal plate with small flattened or molariform teeth. Redescriptions of *H. pantostictus* and *H. labridens*, as well as reviews of *H. bartoni* (Bean 1892) and *H. steindachneri* are included.

Los autores describen a un nuevo género junto con tres especies nuevas de ciclidos de la cuenca del río Pánuco, basado en caracteres cromáticos, morfométricos y merísticos, incluido número de dietes en el margen posterior y medio de la superficie oclusal de la placa faríngea inferior. El análisis discriminante de clasificación para 294 ejemplares del género *Herichthys*, así como 96 pertenecientes al nuevo género dieron una tasa de clasificación correcta de 0.968 para el nuevo género y de 0.986 para *Herichthys*, así como una tasa de clasificación total correcta de 0.982 basado en 42 medidas de la morfométrica sustentando la separación entre ambos taxa superiores. El análisis coincide con la separación *sensu* Stawikowski y Werner, (1998) de *Herichthys* en dos grupos: el grupo *H. cyanoguttatus* y el grupo *H. bartoni*; así mismo los resultados se sustentan en las comparaciones genéticas del Citocromo b por medio del análisis molecular de Hulsey et al. (2003) y Concheiro-Pérez et al. (2006) que colocan al linaje monofilético que conforma al nuevo género y su rama filogenética bajo el grupo corona, como hermano de *Herichthys* con un puntaje de probabilidad mínimo de 0.76 y 1 respectivamente. Nuestro análisis coincide con la validez de "*Herichthys*" *steindachneri* (Jordan y Snyder, 1900) y de *H. pantostictus* (Taylor y Miller, 1983). Sin embargo, nuestros resultados no coinciden con su interpretación de *H. pantostictus* y *H. labridens*. Nuestros resultados muestran que *H. labridens sensu* Taylor y Miller, 1983 está conformado por linajes separados, alopatricos diagnosticables que conforman cuatro especies distintas; y que *H. pantostictus* está conformado por varias poblaciones parapatricas que habitan el Bajo Pánuco y el río Tamesí, así como los tributarios de los sistemas lagunares de Tamiahua y San Andrés adyacentes. *H. pantostictus* muestra una variación geográfica considerable en la morfométrica y la merística, así como en la librea de apareamiento asociados a condiciones lóxicas o léxicas, así como sustrato y composición de la dieta. Mientras que las poblaciones lagunares son "completamente punteadas", caracter que de acuerdo a Taylor y Miller, 1983 es clave para distinguirla de *H. labridens*, muchas poblaciones de río e individuos no presentan puntos en los costados. Es posible que dicho patrón geográfico de distribución es lo que llevó a Taylor y Miller, (1983) a concluir equivocadamente que un "patrón enteramente punteado" es clave para separar a *H. labridens* de *H. pantostictus* y que las poblaciones del río Sabinas, NE de Gómez Farias, y Rancho Pico de Oro, tributario del río Guayalejo son simpátricas o parapatricas con *H. labridens*. Se describen nuevas especies del río El Salto en San Luis Potosí, caracterizada por aleta dorsal XV-XVI, 10-11; aleta anal V 8-9; del río Tamasopo en San Luis Potosí, caracterizada por 10-11 escamas entre la línea lateral y el origen de la aleta anal, un pedúnculo caudal muy largo y bajo 5.4-6.3 y 6.7-7.6 en LP; y de laguna Azteca, Hidalgo, México caracterizada por ojos muy pequeños 4.4-6.3 en LC, base de la aleta dorsal 2.4-2.6 y base de la aleta pectoral 2.9-3.2 ambos en LP, y una placa faríngea inferior angosta con dietes pequeños, aplanados o molariformes. Se presentan redescripciones de *H. pantostictus* y *H. labridens*, así como revisiones de *H. bartoni* (Bean, 1892) y *H. steindachneri*.

2010-11-19 10:30:00 **Successes and Failures of Renovating Two Ponds at Imperial National Wildlife Refuge**

Knecht, Tammy¹, Montony, Andrea², Thorson, Mitch¹. (1-US Fish and Wildlife Service, Fish and Wildlife Conservation Office, Parker, AZ, 2-US Bureau of Reclamation, Boulder City, NV).

In 2007 the Multi-species Conservation Program (MSCP) constructed six ponds at Imperial National Wildlife Refuge (NWR) for the purpose of grow-out facilities for bonytail, *Gila elegans*, and razorback sucker, *Xyrauchen texanus*. A secondary objective was to research different attributes of the ponds relative to native fish growth and survival. Non-native common carp, *Cyprinus carpio*, and mosquitofish, *Gambusia affinis* were present in several of the ponds after construction. Carp and mosquitofish are not piscivorous to adult native species so bonytail and razorback sucker were stocked late in 2007 despite the presence of nonnative fishes. In 2008 an increase of non-natives, plus the discovery of new and potentially piscivorous nonnative fishes began contributing to the low recruitment of native fishes. In 2009 and 2010 US Fish and Wildlife Service and US Bureau of Reclamation partnered to renovate two ponds at Imperial NWR in Yuma County, AZ. These ponds were treated with 4ppm of rotenone since *Cyprinus carpio* and high organic were present and at 0.5ppm of rotenone for all other treatments to eradicate non-native fish. After one rotenone treatment, Pond 3 was successfully eradicated of non-natives, however, only moderate success (nonnatives still present) was obtained on Pond 1 after two treatments. Results varied between the two ponds due to hydrologic differences in pond water level. While the immediate goal of eradicating all non-natives in Pond 1 was not accomplished, the information gained was instituted during the renovation of Pond 3 resulting in a complete kill. The next step for these ponds is to monitor and enhance water quality in an effort to improve overall survivorship of native fish within the Imperial Ponds facility.

2010-11-19 10:45:00 **Population Estimates and Water Quality Summary for Native Fish Backwater Habitats (2009-2010)**

Randall, Robert¹, Thorson, Mitch¹. (1-US Fish and Wildlife Service, Fish and Wildlife Conservation Office, Parker, AZ).

Off-channel, protected habitats are an important management tool for the recovery and conservation of threatened and endangered fishes. Habitats managed by the U.S. Fish and Wildlife Service's Arizona Fish and Wildlife Conservation Office (AZFWCO) follow the strategies outlined by the Lower Colorado River Management Plan (LCRMP). These strategies include 1.) use of hatcheries to produce larger fish for reintroduction, 2.) use of natural or constructed habitats to develop self-sustaining populations and to produce larger fish for release into the mainstem, and 3.) use of exploited habitat made available by reservoir drawdown or drying to establish populations of large adults. We provide a brief summary of the stocking history, population estimates for razorback sucker, *Xyrauchen texanus*, and bonytail, *Gila elegans*, as well as water quality monitoring for selected backwaters from 2009-2010. Since 2005, over 9,000 razorback sucker and bonytail, have been stocked in seven backwater habitats along the lower Colorado River. These habitats have the ability to produce large (>400mm) fish in less than one year with an average growth rate of 10mm per month. Maintaining acceptable water quality throughout the summer months continues to be a challenge, as dissolved oxygen levels (mg/L) in some habitats can decrease below 2mg/L. Information gained from this study will be used to modify management actions and rearing techniques to grow fish of larger size before release into the lower Colorado River. In addition to evaluating survival of the fish once they are in the mainstem, we recommend that success or failure will be measured on the numbers and sizes of fish harvested rather than just initial stocking numbers.

2010-11-19 11:00:00 **Connecting Children With Nature: Ensuring the Future of Conservation**

Johnson, Jennifer¹. (1-U.S. Fish and Wildlife Service).

"Go Outside and Play" most of us remember hearing those four little words throughout our childhood. It is hard for us to imagine childhood without memories of climbing trees, exploring the neighborhood, or just watching the clouds. Research demonstrates that a child's experience with nature, especially before the age of 11, shapes their attitude and behaviors toward nature as an adult. For many kids today, however, exploring nature is fast

becoming a thing of the past. Time in the woods has been replaced by time in front of a computer or television screen; unstructured play has been replaced by organized events run by adults; the art of day dreaming has been replaced by a non-stop schedule. Doctors warn for the first time in American history, life expectancy may actually decrease because of the health impacts of the current childhood obesity epidemic. Playing outdoors and environmental education have been shown to help improve the health of children and increase scores on standardized tests. If we want conservation in the future, we have to have future conservationists. It is up to us, in the natural resources profession, to help keep the child in nature from becoming extinct.

2010-11-19 11:15:00 **Often dry, never boring: the unique and specialized invertebrate communities of ephemeral streams**

Bogan, Michael T. ¹, Boersma, Kate ¹, Lytle, David A. ¹. (1-Oregon State University, Zoology Department).

Ephemeral streams are frequently overlooked by ecologists, despite the fact that they are among the most common stream types in the world. Ephemeral streams serve essential roles, however, in many hydrological and biogeochemical processes in drainage networks, and may provide important dispersal corridors for both aquatic and terrestrial vertebrates and invertebrates. As part of a larger project examining the role of ephemeral streams in population connectivity between perennial stream reaches, we sampled aquatic invertebrate communities in 30 ephemeral streams in southern Arizona. While many taxonomic groups were mainly absent from ephemeral streams (e.g. caddisflies, mayflies), limiting higher-level taxonomic diversity, other groups were quite diverse. We documented at least 35 species of invertebrates from these streams, likely quite an underestimate given the limitations of larval identification for many groups. In general, ephemeral stream communities were comprised of a unique group of winter stoneflies (Capniidae), midges (Chironiomyidae), beetle larvae (Dytiscidae), dobsonflies (Corydalidae), and blackflies (Simuliidae). Blackflies, in particular, seem widely adapted to ephemeral waters with many species known mainly from temporary streams. Even though many of our study streams had been dry for multiple years prior to sampling in January 2010, these communities exhibited relatively high taxa richness and abundance after only 5 weeks of continuous flow. Additionally, many of these specialist ephemeral stream species were rare or absent in adjacent perennial or intermittent reaches. This finding indicates that, in addition to their important roles in drainage-scale processes, ephemeral streams are also important contributors to regional species diversity.

2010-11-19 11:30:00 **Ammonia as a tool for eradication of northern crayfish, *Orconectes virilis***

Ward, David L. ¹. (1-Arizona Game and Fish Department, Research Branch).

Crayfish are not native to Arizona but have been widely introduced with negative impacts to aquatic ecosystems. Crayfish prey upon and compete with many native fish species threatening their long-term persistence. No effective methods currently exist for control or eradication of crayfish. We performed laboratory tests to evaluate the use of ammonia as a tool for removal of crayfish from aquatic systems. Ten northern crayfish, *Orconectes virilis*, were placed in each of 12, 38-liter aquaria and treated with varying concentrations and durations of 10 % ammonia solution. Although crayfish appear dead in less than 15 minutes, they will revive if placed back into fresh water. A concentration of 1 ppt for 4 hours was needed to kill 100% of crayfish at a pH of 7.5. Ammonia is a natural byproduct of fish metabolism and is therefore naturally present in the environment at low levels. Natural bacteria in the environment rapidly convert ammonia to non-toxic nitrate which is utilized by plants. Commercially formulated products that remove ammonia from water are also available and could be used if more rapid detoxification is needed. The low cost of ammonia, its effectiveness at killing crayfish without causing them to crawl out of the water, and the ability of natural bacteria in the environment to quickly detoxify ammonia appear to make it ideal as a tool for removal of invasive crayfish.

2010-11-19 11:45:00 **Overriding Effects of Species-Specific Turbidity Thresholds on Hoop-Net Catch Rates of Native Fishes in the Little Colorado River, Arizona**

Stone, Dennis M. ¹. (1-U.S. Fish and Wildlife Service).

I examined the effects of turbidity, discharge, and temperature on hoop-net catch rates of the four native fishes in the lower Little Colorado River, Arizona (see Stone, 2010, Trans. Am. Fish. Soc. 139: 1150-1170). My findings indicated that native fish catch rates were primarily influenced by whether turbidity levels were below or above the species-specific thresholds of approximately 545 nephelometric turbidity units (NTU) for humpback chub, *Gila cypha*, 221 NTU for speckled dace, *Rhinichthys osculus*, 846 NTU for flannelmouth sucker, *Catostomus latipinnis*, and 70 NTU for bluehead sucker, *C. discobolus*. The effects of discharge were negligible, but discharge did dictate the turbidity level, which predetermined much of the catchability of fish. Catch rates were highest in the high-catch zone consisting of the lowermost turbidities, which ranged up to the start of the transition zone for each species (≤ 54 NTU for humpback chub, ≤ 29 NTU for speckled dace, ≤ 81 NTU for flannelmouth sucker, and ≤ 26 NTU for bluehead sucker), and the secondary effects of temperature were only detectable in this zone. Catch rates within the transition zone decreased at higher turbidities up to the thresholds and thereafter remained consistently low at all higher turbidities within this low-catch zone. The effects of turbidity thresholds on catch rates decreased for larger fish of all species. Theoretically, the effects of turbidity reflect a behavioral switch by native fishes from relying primarily on structural cover (e.g., hoop nets) to turbidity as cover to reduce the predation risk as turbidity levels increase from below to above the species-specific thresholds (sensu Gregory, 1993, Can. J. Fish. Aquat. Sci. 50: 241-246). Moreover, turbidities within the low-catch zone could be totally incapacitating the fishes' visual capabilities, which fishes might perceive as unlimited visual cover. The turbidity threshold concept likely applies to the catch rates of other passive entrapment gears, fishes, and riverine systems.

12:00 – 13:15 LUNCH

GENERAL SESSION – 4: Moderator—Marlis Douglas

2010-11-19 13:15:00 **Growth and survival of Apache trout *Oncorhynchus apache* under static and fluctuating temperature regimes typical of Southwestern streams**

Recsetar, Matthew S.¹, Feuerbacher, Olin¹, Bonar, Scott A.¹, Zeigler, Matt², Colleen, Caldwell². (1-University of Arizona Cooperative Fish and Wildlife Research Unit, 2-University of Arizona Cooperative Fish and Wildlife Research Unit, 3-University of Arizona Cooperative Fish and Wildlife Research Unit, 4-New Mexico State University Cooperative Fish and Wildlife Research Unit, 5-New Mexico State University Cooperative Fish and Wildlife Research Unit).

Increased stream temperatures through global climate change and urbanization will have important implications for fishes worldwide. While there is some information on the effects of elevated water temperatures on Apache trout *Oncorhynchus Apache*, less is known about effects of increased and fluctuating water temperatures over extended time periods, typical of Southwestern desert streams. Therefore, we applied static and fluctuating temperature regimes to determine how each affected the growth and survival of Apache trout. Using a recirculating water system, we tested static temperatures of 16, 19, 22, 25, and 28°C, temperatures that fluctuated +3°C from 16, 19, 22 and 25°C, as well as temperatures that fluctuated +6°C from 19 and 22°C. After a 14 day acclimation at 16°C, 12 days of temperature ramping and 30 day test trials, we determined the LT50 as well as mean growth for each temperature treatment. Results showed the LT50 for Apache trout under static conditions to be 22.9°C, 23.4°C under +3°C fluctuations and 22.9°C under +6°C fluctuations. Growth decreased as temperatures approached the LT50. When comparing static conditions with fluctuating conditions with the same midpoint, growth was less under fluctuating conditions than under static conditions if the temperature fluctuation approached the thermal limit (CTMax). Reduced survival of individual fish, inhibited growth and changes in fish behavior caused by prolonged increased stream temperature will further affect the plight of the species. Therefore temperature tolerance information is critical to those restoring streams for Apache trout and in identifying new stocking locations.

2010-11-19 13:30:00 **Is Havasu Creek a good candidate Stream for translocating humpback chub, *Gila cypha*?**

Sponholtz, Pamela J.¹, Pillow, Michael¹, Healy, Brian². (1-U.S. Fish and Wildlife Service, 2-Grand Canyon National Park).

The Little Colorado River (LCR), a tributary to the mainstem Colorado River in Grand Canyon, provides important spawning and rearing habitat for endangered humpback chub, *Gila cypha*. However, as part of an integrated conservation effort, translocations of humpback chub into other tributaries within Grand Canyon are currently underway. Havasu Creek has long been heralded as the clear choice for humpback chub translocation due to its seemingly congruent water quality, size and flooding regime as the LCR. To test this, biologists from the National Park Service, Grand Canyon National Park (NPS) and the U.S. Fish and Wildlife Service (USFWS) initiated a baseline fishery survey of Havasu Creek below Beaver Falls in Grand Canyon National Park. The goal of this survey was to collect data to help determine whether the tributary is biologically suitable for humpback chub. Specifically, baseline water quality, plant, fish abundance and distribution, macroinvertebrate, and food web data were collected to augment the existing knowledge base of the biotic and physical community in Havasu Creek. Fish captures were low using all gears despite over 1,728 cumulative fishing hours. Native fishes including bluehead sucker, *Catostomus discobolus*, and speckled dace, *Rhinichthys osculus*, were captured along with nonnative rainbow trout, *Oncorhynchus mykiss*. Water temperature ranged from 12.1 through 15.2 °C, while turbidity generally decreased through the study (95-29 NTU). While this survey was only the first of two scheduled baseline surveys, preliminary results indicate that similarities between the LCR and Havasu Creek are greater than the differences and that translocations of HBC into Havasu Creek should be strongly considered.

2010-11-19 13:45:00 **A Second Translocation of Endangered Humpback Chub, *Gila cypha*, and Monitoring of Fish Community in Shinumo Creek, Grand Canyon National Park**

Healy, Brian¹, Omana, Emily¹, Trammell, Melissa², Leibfried, William³, Spurgeon, Jon⁴. (1-Grand Canyon National Park, 2-National Park Service, 3-Museum of Northern Arizona, 4-University of Missouri).

In 2010, the National Park Service partnered with the Arizona Game and Fish Department, Bureau of Reclamation, U. S. Fish and Wildlife Service, and the Museum of Northern Arizona to translocate endangered humpback chub, *Gila cypha*, into Shinumo Creek in Grand Canyon National Park. Three hundred humpback chub originally collected from the Little Colorado River were released into Shinumo Creek in June 2010; 300 were also released into the creek in 2009. In addition to translocation, the primary goals of this project were to: 1) monitor the distribution, abundance, survival, and growth of humpback chub translocated in 2009 and 2010; 2) obtain population estimates for the fish community in Shinumo Creek; and 3) remove non-native rainbow trout, *Oncorhynchus mykiss*. A total of 95 unique humpback chub were collected in 2010; 36 of these were translocated to Shinumo Creek in 2009. Four translocated humpback chub were recaptured below the barrier falls that separates Shinumo Creek from the mainstem Colorado River. Humpback chub translocated in 2010 grew an average of 8.22 mm/month (0.27 mm/day, n= 60). Annual growth in Shinumo Creek was determined from humpback chub translocated in 2009 and averaged 2.68 mm/month (0.09 mm/day, n= 23). We obtained population estimates using mark recapture efforts with mini hoop nets and minnow traps and 3 pass depletions with backpack electrofishers in areas outside of the translocation reach. A total of 908 rainbow trout were removed from Shinumo Creek in 2010 by angling, mini hoop nets, minnow traps, and backpack electrofishers.

2010-11-19 14:00:00 **Changes in fish populations and habitat in East Fork of the Black River from 1988 to 2009**

Meyer J, Kelly¹, Lopez, Michael², Terrill, Mark³. (1-Arizona Game and Fish, 2-Arizona Game and Fish, 3-Arizona Game and Fish).

In 1988, Arizona Game and Fish Department did a survey on fish habitat and fish numbers in the East Fork of the Black River. Since 1988, there had been numerous changes in the stream including: removal of cattle from the upper drainage, construction of pools in the stocked section of stream, changing the stocking from rainbow (*Oncorhynchus mykiss*) to Apache trout (*Oncorhynchus gila apache*), and increase of exotic crayfish in the stream. In 2009, we

repeated the survey of habitat and fishes at the reference sites. The stream habitat has had statistically significant changes. The stream is now significantly narrower, has more stable banks, more canopy cover, less fine sediments, more rubble, and more pools; these changes are consistent with removal of cattle grazing. The stream also had less rooted vegetation in the stream channel which is consistent with establishment of crayfish. We also found significant and dramatic changes in the fish fauna. Brown trout (*Salmo trutta*) and speckled dace (*Rhinichthys osculus*) numbers increased by fourteen fold and three fold respectively. Sonora (*Catostomus insignis*) and desert suckers (*Catostomus clarki*) decreased in number by six fold and fifteen fold respectively. Loach minnow (*Tiaroga cobitis*) have not been found in this stream since 2005 and are likely extirpated. Stocked trout were of low density (0.4 fish/100 meters) in all studies over the past twenty years, with brown trout outnumbering stocked trout at 250 to 1 or more. In addition, stocked trout were not found upstream of areas stocked (where loach minnow have been found). Most fish captured had marks on them from crayfish predation. The biggest threat to loach minnow and native suckers in this drainage are crayfish and exotic wild brown trout.

2010-11-19 14:15:00 **Bonneville Basin Area Report**

Wilson, Krissy ¹. (1-Utah Division Wildlife Resources).

I present a brief summary of activities for this year associated with native aquatic species in the Bonneville Basin. The June Sucker, *Chasmistes liorus*, Recovery Program continues to be very active. Approximately 30,000 (200 mm TL) June sucker were reintroduced into Utah Lake as part of recovery efforts. June sucker are propagated from brood stock held at Utah Division of Wildlife Resources hatchery facility at the Fisheries Experiment Station (FES), Logan, Utah. Record numbers of June sucker are returning to the Utah Lake tributaries to spawn. Least chub, *Notichthys phlegethontis*, was petitioned to list in 2008. The Fish and Wildlife Service's 12-month finding was released in June 2010 as warranted but precluded. The states of Utah, Wyoming, Nevada, and Idaho and Federal agencies form the rangewide team for the northern leatherside chub, *Lepidomeda copei*. The northern leatherside was also petitioned to list and is undergoing a 12-month status review. The southern leatherside chub, *Lepidomeda aliciae* team has finalized the Southern Leatherside Chub Conservation Agreement and Strategy supported by signatory agencies solely in Utah.

2010-11-19 14:30:00 **An evaluation of trout community population change following two years of mechanical removal of non-native brown trout: towards a better understanding of restoration options for imperiled native fishes**

Budy, Phaedra ¹, Thiede, Gary P. ², Saunders, W. Carl ². (1-USGS Utah Cooperative Fish and Wildlife Research Unit, Dept of Watershed Sciences, Utah State University, 2-Dept of Watershed Sciences, Utah State University).

The global loss of biodiversity associated with the spread of invasive species has the ability to alter ecosystem function and presents a ubiquitous scientific and conservation challenge. The biotic resistance hypothesis is one hypothesis invoked to explain the invasion success (or failure) of exotic species introduced into new habitat of exotic species suggesting that invasion is a function of the diversity, density, and/or distribution of the community of native species, and their potential for "strong" interactions with the exotic species (e.g., competition, predation). Towards a broader goal of gaining a better understanding of native trout restoration options, we are testing the hypothesis of biotic resistance in the Logan River using a large-scale, manipulative field study including 1-pass removal and monitoring of 7 km of a high-quality tributary stream, formally dominated nearly exclusively by high densities of brown trout (> 4000/km). Here we report on changes in population abundance, distribution, and structure in response to an approximately 60% removal of non-native brown trout (*Salmo trutta*) abundance. In 2009, we removed 4,855 brown trout from 7 km of stream using single pass electrofishing followed by more than 5,500 with repeat sampling the following year. Although the abundance of brown trout actually increased after removal the second year, the increase was largely due to a dramatic increase in young of the year and juvenile recruitment success. The number of large, adult brown trout was significantly lower the second year, and the native trout also responded with the first successful recruitment event observed in over ten years. The large increase in brown trout recruitment from year 1 to year 2 indicates the brown trout population was limited by density dependence. In addition, this response demonstrates this tributary habitat supports trout recruitment in general, with few if any other limiting factors, and thus suggests it should provide excellent spawning and rearing grounds for native cutthroat trout (*Oncorhynchus clarkii utah*) restoration. The potential role of biotic resistance has important implications for native fish conservation and restoration – it may be adequate to simply shift the balance to the native fish, but not eliminate non-natives, to prevent further invasion and establishment of non-native trout.

2010-11-19 14:45:00 **Status of least chub, *Notichthys phlegethontis*, in Utah**

Mellon, Cassie D. ¹. (1-Utah Division of Wildlife Resources).

The least chub *Notichthys phlegethontis* is a small monotypic minnow endemic to the Bonneville Basin of Utah. Utah Division of Wildlife Resources considers the least chub to be a Tier I sensitive species which is managed under a voluntary multi-agency conservation agreement and strategy established in 1998. A proposed listing of least chub under the Endangered Species Act was withdrawn by the U.S. Fish and Wildlife Service (Service) in 1999 due to conservation actions established in the conservation agreement and strategy. The least chub was again petitioned for listing in 1997 and in 2010, the Service found listing of least chub as warranted but precluded. Many conservation actions such as: habitat enhancement, securing water rights to protect instream flow, creation of refuge populations, and non-native fish removal have been undertaken by the conservation team and have had great benefits to least chub. One novel conservation action has shown great promise for least chub conservation. In 2010, the Salt Lake City Mosquito Abatement District replaced the use of non-native western mosquitofish, *Gambusia affinis*, with least chub for mosquito control in backyard ponds. This has been a successful transition from use of a highly invasive nonnative to a native fish with the same desired effect of effective mosquito control, and an important benefit of public education. In spite of all the work that has gone into least chub conservation, there are still threats to the long-term persistence of least chub, primarily water withdrawal and the spread of invasive nonnative fish.

2010-11-19 15:00:00 **A mitochondrial DNA phylogeny of the mountain suckers, *Pantosteus***

Unmack, Peter J. ¹, Shiozawa, Dennis K. ², Laitinen, Nina J. ², Secor, Carol L. ³, Smith, Gerald R. ⁴, Mayden, Rick L. ⁵, Dowling, Tom E. ³. (1-Duke University, National Evolutionary Synthesis Center, 2-Brigham Young University, Department of Biology, 3-Arizona State University, School of Life Sciences, 4-University of Michigan, Museum of Zoology, 5-Saint Louis University, Department of Biology).

Mountain suckers (genus *Pantosteus*) have an interesting distribution across western North America stretching from southwestern Canada to northwestern Mexico. Essentially they straddle one of the most geologically active regions of the continent which makes them interesting in terms of the regional biogeography. Currently six species are recognized, *P. clarkii* Desert Sucker, *P. discobolus* Bluehead Sucker, *P. nebuliferus* Nazas Sucker, *P. platyrhynchus* Mountain Sucker, *P. plebeius* Rio Grande Sucker and *P. santaanae* Santa Ana Sucker. Many of these species are often sympatric with

another sucker from the genus *Catostomus*. Sampling for each species included multiple representatives, typically covering their geographic range. Multiple outgroups were included from the genus *Catostomus* as well as several more distantly related suckers. Phylogenetic data was collected from nine mitochondrial genes for a total of 8055 base pairs. Both maximum likelihood and maximum parsimony produced well resolved topologies with only two minor differences. Our results confirm what others have suggested relative to the taxonomic diversity within the group being underestimated. *Pantosteus platyrhynchus* consisted of five lineages, two of which appear to have earlier been introgressed with *P. discobolus*. Three distinct lineages were also found in both *P. discobolus* and *P. plebeius*. Based on the molecular divergences, all of these distinct lineages likely deserve separate species recognition. Phylogenetically and geographically *Pantosteus* can be divided into three lineages. The most basal lineage consisted of *P. platyrhynchus* (excluding Bonneville Basin) which inhabits the northern range of the genus. The second lineage contained *P. plebeius* and *P. nebuliferus* from the southern most portion of the range of the genus. The geographically central *Pantosteus* species formed the third major lineage (*P. santaanae*, *P. clarkii*, *P. discobolus*, Bonneville *P. platyrhynchus*).

2010-11-19 15:15:00 **Longer food chains and crowded niche space: understanding trophic interactions between non-native and endemic, riverine desert fishes**

Walsworth, Timothy ¹, Budy, Phaedra ², Thiede, Gary P. ¹. (1-Department of Watershed Sciences, Utah State University, 2-USGS Utah Cooperative Fish and Wildlife Research Unit, Utah State University).

Biologists studying community structure in lotic systems often argue that abiotic factors are most influential in shaping riverine communities, such that fish-based recovery projects often focus on restoring habitat and other physical features to a perceived historical state. However, the changes in abiotic factors are often accompanied by the introduction and establishment of non-native species, fundamentally altering the flow of energy and trophic structure in these degraded systems. The San Rafael River in southeastern Utah has experienced degradation representative of many desert streams, and is home to populations of the flannelmouth sucker (*Catostomus latipinnis*), bluehead sucker (*Catostomus discobolus*), and roundtail chub (*Gila robusta*), each subject to a range-wide conservation agreement and collectively known as the "Three Species." Downstream sections of the river have been invaded by many non-native species, which have established populations in the river, while the upstream sections of the river are almost entirely comprised of native fishes. In this study we examined the effects of the non-native fishes on the food web in the San Rafael River using stable isotope analysis of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$; we used convex hulls to estimate the trophic niche space of species in both sections of the river to investigate the potential for competition. Four non-native species occupy a higher, previously unoccupied trophic level in the San Rafael River, resulting in a longer food chain. The Three Species occupied similar trophic niche spaces both in and out of the presence of non-native fishes. However, the trophic niche spaces of non-native fish overlap the bluehead and flannelmouth suckers' trophic niche spaces completely, and 89% of the roundtail chub's trophic niche space, suggesting a strong potential for competition for food and other limited resources. These findings suggest that efforts to restore populations of these native fishes need to include actions to mediate the effects of these non-native fishes, not only the loss of habitat.

2010-11-19 15:30:00 **The need for new and innovative solutions in Utah's endangered and sensitive species programs**

Jones, Sarra L. ¹. (1-Utah Division of Wildlife Resources).

Programs aimed at recovering endangered species and managing sensitive species have a common primary goal: to reverse the decline of imperiled species. Because ecosystems are extremely complex and many factors may contribute to the decline of these species, remedying the situation is often complicated. New and innovative techniques have been proposed and used in Utah's endangered species recovery programs. I will briefly discuss the state of the endangered species recovery programs and other sensitive species programs currently in Utah, how we are using creative solutions (i.e., commercial carp removal), and proposed ideas (i.e., floating weirs) to improve the status of these species.

2010-11-19 15:45:00 **A comparative investigation of population size, structure, movement patterns and vital rates between two populations of bluehead sucker (*Catostomus discobolus*) in the Weber River, Utah: Identifying limiting factors to guide conservation**

Thompson, Paul ¹, Webber, Aaron ², Budy, Phaedra ³, McKay, Samuel ⁴. (1-Utah Division of Wildlife Resources, 2-United States Fish and Wildlife Service, 3-Utah State University, USGS - UCFWRU, 4-Utah Division of Wildlife Resources).

Bluehead suckers (*Catostomus discobolus*) historically occurred in the Colorado River Basin and the Upper Snake, Bear, and Weber rivers; however, sampling in the Bonneville Basin in Utah has identified viable populations remaining only in the Weber River. Towards a goal of identifying limiting factors and prioritizing conservation efforts, we compared population size, structure, movement patterns, and vital rates of two populations of bluehead sucker that occupy very different 10+ km river reaches of the Weber River. Multiple pass, mark-recapture electrofishing indicated that relatively small populations of 225 (141-416) and 546 (423-772) fish/reach remain with little variation in population size across the three years of study. Bluehead sucker in the Weber River appear to obtain larger sizes than other systems (up to 575 mm TL). Based on recapture data, growth of larger bluehead sucker (>400 mm TL) was 12.5 g/year; however, growth of smaller fish (250-300 mm TL) was 167 g/year. In addition, recruitment appears to be limited in one reach; in contrast, annual adult survival rates are high (~80%) and decrease only slightly with size, likely due to natural senescence. The largest bluehead sucker movements observed during the study were 15 km downstream (over 6 months) and 5 km upstream (over 12 months), indicating that these fish historically used large sections of the Weber mainstem. PIT tag detections at a small flat-plate antenna indicated that 88% of movements occurred during night periods. Based on these results and the history of the Weber River, probable limiting factors for bluehead suckers include: 1) an extremely modified hydrograph during spring peak flows (magnitude, duration, and timing), 2) cooler on-average summer water temperatures due to upstream dam releases, and 3) high densities of exotic brown trout.

2010-11-19 16:00:00 Do introduced brown trout affect native fishes in western United States streams?

Burbank, Nora K.¹, Hawkins, Charles P.¹. (1-Utah State University).

Introduced brown trout (*Salmo trutta*) are known to negatively affect native fish species. However, these effects have typically been observed in systems where other trout species are absent. In many North American streams, fish species have evolved with other Salmonids, and it is unclear what effects brown trout have on these species. We analyzed the relationship between brown trout and the distribution and abundance of sculpins (*Cottus* spp.) and speckled dace (*Rhinichthys osculus*) to assess if brown trout have affected these native species. We used the same methods to analyze the relationship between native cutthroat trout (*Oncorhynchus clarkii*) and sculpins and speckled dace to see how the effect of brown trout compares to the effect of a native trout species. We found that sculpins were positively associated with cutthroat trout, but not associated with brown trout. For speckled dace, we found no relationship with brown trout, and a weakly negative relationship with cutthroat trout. The lack of a negative relationship with brown trout implies that sculpins and speckled dace possess behaviors and/or adaptations that allow them to coexist with brown trout.

2010-11-19 16:15:00 Spatial Distribution and Habitat Use of Least Chub in Three Geographically Distinct Spring Systems

Grover, Mark¹. (1-Utah Department of Natural Resources, Division of Wildlife Resources).

The least chub, *Notichthys phlegethontis*, is a cyprinid species endemic to the Great Basin of Utah, but currently restricted to six isolated natural populations. Population surveys, using minnow traps, and standardized habitat inventories were conducted in 2010 for three genetically distinct populations occupying spring systems in three separate drainage basins: Mona Springs in the Utah Lake Drainage, Mills Valley in the Sevier River Drainage, and the Leland Harris spring complex in the Snake Valley of Utah's West Desert. Least chub were abundant in many of the springs and associated pools at Mills Valley and Leland Harris, but were absent from terminal pools characterized by high salinity, high conductivity, and sparse vegetative cover. Numbers of least chub captured per trap at sampling sites were positively correlated with the maximum water depth and steepness of the shoreline within the sampling area, but not with average depth or surface area. Least chub were rarely detected at Mona Springs, where the fish community was dominated by introduced cyprinidontiform species, including western mosquitofish, *Gambusia affinis*, which adversely impact least chub through interference competition. Extensive habitat connectivity, relatively stable water levels, and benign water chemistry (e.g., pH values of 7-8) probably permit the movement of non-native species throughout the Mona Springs system. By contrast, non-native fish species were absent from Leland Harris and made up a small proportion of the fish community at Mills Valley. Non-native fishes were apparently transient at Mills Valley sites where least chub were most abundant, which tended to be complex, semi-isolated, and prone to spatial or seasonal variation in water chemistry (e.g., pH values >10 during late summer). Favorable habitat for least chub in the three spring systems consists of springheads, channels, and pools characterized by adequate vegetative cover, areas of deep water, and the absence of invasive cyprinidontiform fishes.

17:00-18:30 BUSINESS MEETING

18:30-Open BANQUET

Saturday, 20 November 2010

GENERAL SESSION 5: Moderator--Jeanette Haegele

2010-11-20 08:30:00 DESERT FISHES RESEARCH AND MANAGEMENT IN TEXAS DURING 2010

Garrett, Gary¹, Edwards, Robert², Allan, Nathan³. (1-Texas Parks & Wildlife Dept., 2-University of Texas - Pan Am, 3-US Fish & Wildlife Service).

A new, 2nd ciénega has been completed at Balmorhea State Park to replace an old refuge canal for Comanche Springs pupfish, *Cyprinodon elegans*, Pecos gambusia, *Gambusia pecosensis*, and endemic invertebrates. The new ciénega will provide a more stable habitat for the aquatic species community and will be named in honor of Clark Hubbs. An intense monitoring study of the system is underway that includes analyzing energy dynamics. Almost 1.5 million Rio Grande silvery minnows, *Hybognathus amarus*, have been released into the Big Bend region of the Rio Grande during the last three years. Monitoring efforts have yielded adults, eggs, larvae and juveniles. Additionally, stocked adults have been collected approximately 80 kilometers downstream from stocking site as well as 4 kilometers up a small tributary creek. Watershed-level conservation efforts are underway in the Big Bend region. These include restoration on private lands in the drainages of Alamito and Terlingua creeks as well as numerous projects being formulated through the Big Bend Bi-national Conservation Cooperative, the Desert Landscape Conservation Cooperative and the Desert Fish Habitat Partnership.

2010-11-20 08:45:00 **The Fishes of Texas Project – status of compilation, standardization and utilization of museum-vouchered fish collection data / El Proyecto “Peces de Texas” – estado actual de recopilación, normalización y aplicación de registros en museos de colectas de peces**

Hendrickson, Dean A.¹, Cohen, Adam E.¹, Labay, Benjamin¹, Sarkar, Sahotra², Sissel, Blake². (1-University of Texas at Austin, Texas Natural History Collection, 2-University of Texas at Austin, Section of Integrative Biology).

This project aspires to compile and synthesize knowledge of the spatial and temporal distribution of Texas' freshwater fish fauna using museum-vouchered specimen records. Data from 33 institutions were standardized and merged. The 81,218 occurrence records include all but of a few of the state's approximately 280 species found in freshwaters across a total of 5,729 localities sampled by 10,954 discrete collecting events between 1854 and 2009. Precise manual georeferencing of 87% of the records (with estimates of placement error) facilitated discovery of probable identification errors via mapping and flagging of geographic outliers followed by identification verification by specimen inspection. In some collections up to 70% of flagged records proved to be mis-identified, but correct identifications sometimes extended known ranges. High error rates indicate that un-vouchered identifications should always be interpreted cautiously. The database continues to improve and grow. In the past year we uncovered 7 more institutions with relevant data. We also greatly accelerated cataloging of backlogged specimens at our own collection, and acquired previously un-cataloged specimens from other collections. Once georeferenced and added to our database in phase 2, these new data will increase the total occurrence records to > 103,000 (= 27% growth). Ecological Niche Models (or Species Distribution Models) generated from this data set for nearly all freshwater species proved highly capable of predicting distributions and are now being projected onto various climate change scenarios. Use of the models in conservation network modeling is currently being explored, also under various climate change scenarios.

El proyecto “Peces de Texas” aspira recopilar y sintetizar conocimiento de la distribución temporal y espacial de las especies ícticas del estado por medio de registros basados en especímenes preservados en museos. Datos de 33 instituciones fueron normalizados y juntados. Resultaron 81,218 registros de ocurrencia que abarcan todas (excepto algunas pocas) las 280+ especies conocidas de aguas dulces del estado, registrados de 5,729 localidades muestreadas en 10,954 ocasiones entre 1854 y 2009. Georeferenciación precisa manual del 87% de las localidades facilitó descubrimiento de posibles errores de identificación a través del mapeo de sitios y señalización de los fuera de la distribución antes reconocida, seguido por verificación de identificaciones por medio de inspección de especímenes. Hasta 70% de los señalizados han comprobado ser mal identificados, o a representar extensiones de la distribución conocida. Altas tasas de error indican de identificaciones sin “vouchers” deben de ser interpretadas con precaución. El año pasado descubrimos 7 más instituciones con datos relevantes, hemos acelerado catalogación de especímenes atrasados en nuestra propia colección, y hemos adquirido y catalogado especímenes de otras colecciones inactivas. Una vez georeferenciadas y agregadas en fase 2, estos nuevos datos incrementarán el número de registros a > 103,000 (=un crecimiento de 27%). Modelos de Nichos Ecológicos (o Modelos de Distribuciones de Especies) generados de este base de datos para casi todas las especies de agua dulce del estado han comprobado capaces de predecir con alta precisión las distribuciones y estamos ahora en el proceso de proyectar los al futuro usando varios escenarios de cambio climático. Además, estamos explorando uso de los mismos modelos en programas de modelación de redes de conservación, también bajo varios escenarios de cambio climático.

2010-11-20 09:00:00 **Invasive snails and desiccation – a potential control measure?**

Rogowski, David¹. (1-Texas Tech University, Dept. Nat. Resources Mgt).

Many spring systems in the southwest have been modified for the benefit of the charismatic fauna. Modification of springs often includes channel reconstruction and recontouring, with little thought given to how habitat modifications may affect invertebrates, native or invasive. The red-rimmed melania, *Melanoides tuberculatus* and the quilted melania, *Tarebia granifera* are invasive tropical aquatic snails that have been introduced throughout the world, including Mexico, and 12 states within the US (eg. AZ, CA, NV, TX, UT, etc.). Control of these parthenogenetic aquatic gilled snails has been problematic if not impossible. In a laboratory experiment we investigated desiccation tolerance of these invasives from two spring systems in Texas. Red-rimmed melania were able to survive out of the water up to 7 and 11 days, depending on the originating spring system (Balmorhea and Diamond Y, respectively). Quilted melania were more sensitive and not able to survive more than 2 days out of the water, with one exception: one snail (out of 12) in the 6 day desiccation treatment survived. A potential control measure for these hardy invasives might be accomplished through the diversion and drying out of a spring system and the associated sediment.

2010-11-20 09:15:00 **Genetic effective size and fragmentation of the threatened Leopard Darter, *Percina pantherina***

Schwemm, Michael R.¹, Echelle, Anthony A.¹, Van Den Bussche, Ronald A.¹. (1-Oklahoma State University, Department of Zoology).

A history of low abundance and limited distribution has characterized *Percina pantherina*, a percid endemic to the Little River system, SE Oklahoma and SW Arkansas. Concerns of habitat fragmentation by reservoir construction and agricultural/silvicultural perturbations have been apparent since its federal listing in 1978. Here, we compare levels of heterozygosity and population subdivision and estimate genetic effective sizes to evaluate the potential loss of genetic variation. Genetic variation at eight microsatellite loci revealed relatively low levels of allele richness ($A_R = 3.74$ to 6.60) and heterozygosity ($H_e = 0.461$ - 0.636) within populations. Tributary streams (now separated by at least one reservoir) differed significantly in allele frequencies, with 10.2% of the genetic diversity attributable to differences among tributaries. Maximum Likelihood (MIGRATE) and Bayesian (MSVAR) coalescence approaches indicate that current effective population sizes are similar with those from summary statistics (ONeSAMP and LDNe) and about three orders of magnitude smaller than the ancestral population sizes and one order smaller than the long-term effective sizes. The point estimates of time since the start of the decline (69 to 398 yrs) and the associated 95% support limits are consistent with the hypothesis that low diversity is a result of fragmentation in the last century.

2010-11-20 09:30:00 **Population dynamics of *Gambusia nobilis* and *Cyprinidon elegans* in San Solomon Cienega, Balmorhea State Park, Texas**

Deluane, Kelbi¹, Deaton, Raelynn¹, Garrett, Gary², Hargrave, Chad¹. (1-Department of Biological Sciences, Sam Houston State University, 2-Texas Parks and Wildlife, Inland Fisheries).

Historically, Comanche Springs pupfish (*Cyprinidon elegans*) and Pecos gambusia (*Gambusia nobilis*) inhabited two large desert wetland (ciénega) systems in West Texas. However, human alteration of these systems for agricultural irrigation destroyed the associated wetland habitats, and endangered

the persistence of Comanche Springs pupfish and Pecos gambusia. In an attempt to conserve these endangered species, the Texas Parks and Wildlife Department (TPWD) restored a critical desert wetland habitat by creating the San Solomon Ciénega at Balmorhea State Park in 1996 through a cooperative effort among private, state, and federal entities. As a result of this action the Comanche Springs pupfish and Pecos gambusia, have flourished in this location. In Fall 2009, TPWD created a second ciénega at Balmorhea State Park by replacing the small, refuge canal with a new 'natural' wetland habitat. Here we will report on seasonal monitoring efforts to document the establishment and development of *C. elegans* and *G. nobilis* populations in this new ciénega. We compare the population dynamics of these fishes in the new ciénega to the dynamics of these populations in the established ciénega. In general, seasonal populations in the established ciénega have been relatively stable since Spring 2008. Populations in the new ciénega were extremely low during winter '09 and spring '10 following immediate creation of the wetland. However, by summer '10, populations of both species increased by an order of magnitude and reflect densities in the established ciénega habitat.

2010-11-20 09:45:00 Food Web Structure and Potential Community-level interactions in a reconstructed desert wetland, San Solomon Ciénega, Balmorhea State Park, Texas

Hamontree, Sam ¹, Garrett, Gary ², Deaton, Raelynn ¹, Hargrave, Chad ¹. (1-Department of Biological Sciences, Sam Houston State University, 2-Texas Parks and Wildlife, Inland Fisheries).

In an attempt to conserve two endangered fishes (*Cyprinidon elegans* and *Gambusia nobilis*), the Texas Parks and Wildlife Department (TPWD) restored a critical desert wetland habitat by creating the San Solomon Ciénega at Balmorhea State Park in 1996 through a cooperative effort among private, state, and federal entities. This re-creation of a desert wetland habitat within the boundaries of the original, natural ciénega provided critical habitat necessary for survival of desert wetland biota. As a result, the native fish fauna, including *Cyprinidon elegans* and *Gambusia nobilis*, have flourished, and this location now provides a natural habitat with the largest known concentration of these taxa. It is believed that the primary benefit of the San Solomon Ciénega to the survival of these endangered fishes is the creation of a "natural" habitat with viable ecosystem-level processes that promote population stability. However, there have been no concerted efforts to document the community and ecosystem dynamics of this system. Herein, we describe seasonal gut content and stable isotope data for the fish community in San Solomon Ciénega. In general, food resources for the fishes in these ciénega are relatively consistent across season. Algae is an important food resource for *C. elegans*. Both *G. nobilis* and *G. geiseri* (an invasive) are linked to terrestrial and aquatic invertebrates. These two species have high diet overlap and are likely to compete for limiting food in these systems. *Astyanax mexicanus* (also invasive) is largely predatory feeding on aquatic and terrestrial invertebrates as well as small fishes. This species also play an important role in limiting abundance of native fishes through predation or competition.

2010-11-20 10:00:00 Geomorphic Transformation of In-stream and Riparian Habitat on the Rio Grande in the Big Bend Region

Dean, David J ¹, Schmidt, John C ¹. (1-Intermountain Center for River Rehabilitation and Restoration, Utah State University).

The endangered Rio Grande silvery minnow, *Hybognathus amarus*, resides in only 7% of its historic range. Population declines have generally been attributed to the loss of habitat due to reductions in stream flow by dams, diversions, and pumping, as well as channelization. As part of the silvery minnow recovery plan, the silvery minnow is being re-introduced to 2 parts of its historic range, one being the Big Bend reach along the U. S. - Mexico border. The Rio Grande in the Big Bend region, however, has changed dramatically during the past century, shifting from a wide river with transient channel margins, backwaters, and side-channels to a simple channel with steep, definable, vegetated banks and few channel bars. The channel narrowed by more than 50% since the early 1900s. Rapid narrowing continues today. Between 1991 and 2008, the active channel width of the Rio Grande in Big Bend National Park narrowed by 35-50%. Narrowing occurred by vertical accretion of fine-grained deposits inset within natural levees. Vertical accretion occurred on top of alternate bars of sand and gravel. In two floodplain trenches, 2.75 and 3.5 m of vertical accretion were measured, all of which occurred in this 17 year period. In some localities, nearly 90% of bare, active channel bars were converted to vegetated floodplains during the same period. Channel narrowing coincided with a rapid invasion of non-native riparian vegetation, *Tamarix chinensis* and *Arundo donax* which led to increased bank roughness, and created a positive feedback of decreased flow velocities, an upward shift of the stage-discharge relations, overbank flooding at lower discharges, and continued vertical accretion. This resulted in a loss of channel capacity, and thus, although peak flows were reduced by 48% and the percent exceedance of both the two-year flood and mean annual flow declined, overbank flooding continued. The magnitude of these historic geomorphic and habitat changes, and the magnitude of flow depletion on the northern branch of the Rio Grande and on the Rio Conchos, cannot be ignored in the development of recovery plans for the endangered endemic fish species.

2010-11-20 10:15:00 Towards a Rationale Basis for Planning Rehabilitation of Lost Aquatic Habitats of in the Rio Grande and Colorado River Watersheds

Schmidt, John C. ¹. (1-Utah State University).

Although the demise of many endemic fish species in the Rio Grande and Colorado River watersheds is also related to biological and hydrologic factors, transformation of the physical template of the aquatic habitat is clearly important to the threatened or endangered status of many species. Planning for the rehabilitation of lost habitats requires four key elements. First, such planning necessitates a clear understanding of the pre-disturbance fluvial geomorphology of these watersheds and of the relation between channel conditions and watershed runoff and sediment yield. Most of these streams carried naturally large suspended sediment loads, and their hydrology was determined by snowmelt in the Rocky Mountains and Utah High Plateaus, or by summer and fall rains. Dams and diversions affect runoff and sediment yield patterns differently depending on where in the watershed the dams and diversions occur. Secondly, rehabilitation planning necessitates understanding the present, transformed condition of the region's rivers, because such analysis allows quantification of the difference in channel form and process between the processes in which the target species evolved and the conditions in which these species persist today. Thirdly, rehabilitation planning requires undertaking the field and experimental science by which the tradeoffs between effort and species recovery can be understood. In other words, to what degree is species recovery dependent on returning the stream flow or sediment supply regime to pre-disturbance conditions? Do stream channels need to be shifted to the wide, shallow condition characteristic of the early to mid-20th century? How much effort, in terms of non-native woody vegetation removal or channel reconfiguration, needs to be undertaken to achieve these goals? Fourth, rehabilitation planning requires a watershed perspective with which to guide decisions of where to work and how much effort to undertake? Is it acceptable to accept partial restoration of each part of the drainage network or is full restoration to pre-disturbance conditions required for some streams? If so, then which streams? Are there dams whose existence fundamentally jeopardizes the recovery of target species? Are there streams so transformed that restoration ought not to be attempted? This four-step approach for planning rehabilitation of channel geomorphology is illustrated using results from a 20-year geomorphology research program describing channel change in the Colorado River watershed and in the Big Bend region of far west Texas.

2010-11-20 10:30:00 **Native fish conservation and management in the upper/middle Rio Grande, Pecos River, Canadian River, Tularosa and Guzman basins, New Mexico during 2010.**

Remshardt, W. Jason ¹, Davenport, Stephen R. ¹, Dudley, Robert K. ², Platania, Steven P. ², Propst, David L. ³. (1-U.S. Fish and Wildlife Service, 2-American Southwest Ichthyological Researchers, 3-New Mexico Department of Game and Fish).

Native fish conservation in New Mexico is accomplished through long term monitoring of protected species, captive propagation, stream restoration, and interagency water management. Long term monitoring and research programs track many rare native desert fishes including Rio Grande silvery minnow (*Hybognathus amarus*) in the Rio Grande, New Mexico, and Pecos bluntnose shiner (*Notropis simus pecosensis*) in the Pecos River, New Mexico. In 2010, the revised Recovery Plan for Rio Grande silvery minnow was finalized. Multiple research and monitoring projects for Rio Grande silvery minnow continued in 2010 including population monitoring, population estimation, reproductive monitoring, and fish passage monitoring. For population monitoring, the most recent data available is from 2009. Mean October densities (#/100m²) of Rio Grande silvery minnow collected from 20 sites in the Middle Rio Grande, NM were not significantly different in 2009 (M=16.15, SD=19.07) as compared to 2008 (M=8.32, SD=7.42). However, low flows and river drying (July-September) appear to be negatively impacting the population in 2010. Since 2006, population estimates have been used as an additional resource to standard monitoring for management. Reach-specific population estimates of Rio Grande silvery minnow in 2009 were highest in the Isleta Reach (N=1,602,348 ± 457,764) and lowest in the San Acacia Reach (N=923,352 ± 568,776). The total population estimate for all reaches combined was 3,476,873 ± 918,779 representing an increase from the 2008 estimate of (N = 2,283,790 ± 740,860.73). Estimates of the probability of extinction were relatively low for age-0 individuals (0.0486) but higher for age-1 and age-2 individuals (0.1750 and 0.1234, respectively), based on site occupancy estimates from 2005 to 2009. Analysis of Rio Grande silvery minnow reproductive output in the San Acacia Reach revealed a significant difference (F=6.36; p<0.05) between 10 km from release locations, as well as documenting their ability to move upstream in a rock channel fish passageway. Future work will include additional release of PIT-tagged fish to document specific pre-spawn movements of adult fish. United States Fish and Wildlife Service and U.S. Bureau of Reclamation in 2010 began working on phase II of Pecos River restoration to improve habitat for native fishes including Pecos bluntnose shiner. Phase I was completed in 2009 at Bitter Lake National Wildlife Refuge where an isolated river meander was reconnected to flow. Phase II will restore an additional 1.5 river miles downstream of Phase I. In association with this restoration, USFWS began a pilot project in 2010 to monitor the effectiveness of river restoration in creating larval fish habitat in low-velocity habitats.

2010-11-20 10:45:00 **Ecology of rapid replacement—Rio Grande silvery minnow vs. plains minnow—middle Pecos River, New Mexico**

Hoagstrom, Christopher W. ¹, Zymonas, Nikolas D. ², Davenport, Stephen R. ³, Propst, David L. ², Brooks, James E. ³. (1-Weber State University, Department of Zoology, 2-New Mexico Department of Game and Fishes, Conservation Services Division, 3-U.S. Fish & Wildlife Service, New Mexico Fish and Wildlife Conservation Office).

A non-native population of plains minnow *Hybognathus placitus* in the Pecos River, New Mexico, USA, replaced the endemic, ecologically similar Rio Grande silvery minnow *Hybognathus amarus* in less than 10 years. Competitive exclusion is hypothesized as a mechanism of replacement. The following evidence was examined for potential support of this hypothesis: (1) the historical population trend of *H. amarus* versus *H. placitus*; (2) relative suitability of the modified flow regime for *H. amarus* versus *H. placitus*; (3) potential for habitat overlap; and (4) spawning periodicity and body length in the non-native population of *H. placitus*. Historical data indicate *H. amarus* did not decline until *H. placitus* was present, after which it disappeared rapidly and *H. placitus* proliferated. The natural flow regime of the Pecos River was changed via base-flow reductions and capture of spring snowmelt runoff, making it similar to flow regimes associated with likely source populations of non-native *H. placitus*. Spring runoff is an important spawning cue for *H. amarus*, but not *H. placitus* and *H. placitus* appears to be naturally more tolerant of diminished streamflow. Extant *H. placitus* were associated with a relatively pristine river reach that was most likely the stronghold for the replaced *H. amarus* population. Given high ecological similarity, habitat overlap was likely high during the period of replacement. *H. placitus* in the Pecos River had a protracted spawning season (April through September), whereas extant *H. amarus* in the Rio Grande had a short spawning season (a few days in May or June during snowmelt runoff). Most *H. amarus* die after their first spawning season and few exceed 60 mm standard length (SL), whereas quite a few *H. placitus* survive at least until their second spawning season and exceed 60 mm SL. Co-occurrence of multiple spawning cohorts may stabilize annual reproductive output of *H. placitus* and larger individuals may be more fecund and produce larger eggs that survive better. Spawning flexibility, greater size, and higher environmental tolerance likely gave *H. placitus* a reproductive and survival advantage over *H. amarus*, consistent with a deterministic pattern of rapid species replacements in the plains, in which tolerant, competitive species from the Red River drainage or Gulf of Mexico coast rapidly replace more sensitive, endemic congeners in disturbed, remnant habitats.

2010-11-20 11:00:00 **Does Trophic or Life-History Theory Predict Fish Biomass-Primary Production Relationships in the upper Gila River, NM, USA?**

Whitney, James E. ¹, Gido, Keith B. ¹. (1-Kansas State University, Division of Biology).

Numerous trait classifications can be used to predict fish community responses to spatial heterogeneity in environmental conditions, including trophic guilds and life-history strategies. These trait-based approaches could be particularly useful in describing spatial variation in the abundances of native and non-native fishes in the upper Gila River of southwestern New Mexico, owing to the divergence in trophic classification and life-history strategy between natives and non-natives. Native fishes are generally herbivore-invertivores, and are representative of either periodic or opportunistic life history strategies, whereas non-native fishes are generally invertivore-piscivores, and are characteristic of the equilibrium life-history strategy. Ecological theory provides contrasting predictions of the response by trophic guilds and life-history strategies to variation in primary production. From trophic theory, it is predicted that the biomass of invertivore-piscivores (nonnatives) should increase along a gradient of primary productivity, while the biomass of herbivore-invertivores (natives) remains constant. Conversely, life-history theory predicts that the biomass of equilibrium strategists (nonnatives) should decrease with increasing primary productivity, while the biomass of periodic and opportunistic strategists (natives) increases. These predictions were tested with measurements of fish biomass and primary production across six longitudinally-positioned sites in the upper Gila River of southwestern New Mexico three times annually during 2008 and 2009. Simple linear regression was used to test the significance of relationships between trophic guild and life history strategy with primary production. Consistent with life history theory predictions, equilibrium strategist biomass demonstrated a marginally significant negative relationship with primary production in both 2008 ($R^2=0.60$; $df=5$; $p=0.07$) and 2009 ($R^2=0.41$; $df=5$; $p=0.17$), with opportunistic strategist

biomass also demonstrating the predicted positive relationship with primary production in 2008 ($R^2=0.64$; $df=5$; $p=0.06$) and 2009 ($R^2=0.69$; $df=5$; $p=0.04$). The response of periodic strategist biomass to primary production did not match predictions either year. Consistent with predictions, no relationship was found between herbivore-invertivore biomass and primary production in either year. However, invertivore-piscivore biomass demonstrated the opposite pattern of prediction, showing a marginally significant negative relationship with increasing primary production in both 2008 ($R^2=0.60$; $df=5$; $p=0.07$) and 2009 ($R^2=0.41$; $df=5$; $p=0.17$). Application of this knowledge could aid in the conservation of native fishes and eradication of non-natives, through targeted removal efforts in areas where environmental conditions benefit the equilibrium life history strategy (i.e. low primary productivity). Biomass responses of trophic guilds and life history strategists to other environmental gradients (hydrologic variability) should be examined to gain further insight into the mechanisms governing native and non-native fish biomass.

2010-11-20 11:15:00 **Genetic effective size, N_e , tracks density in a small freshwater cyprinid, Pecos bluntnose shiner (*Notropis simus pecosensis*).**

Osborne, Megan J. ¹, Davenport, Stephen R. ², Hoagstrom, Christopher W. ³, Turner, Thomas F. ¹. (1-University of New Mexico, 2-U.S Fish and Wildlife Service, 3-Weber State University).

Genetic monitoring tracks changes in measures of diversity including allelic richness, heterozygosity and genetic effective size over time, and has emerged as an important tool for understanding evolutionary consequences of population management. One proposed application of genetic monitoring has been to estimate abundance and its trajectory through time. Here, genetic monitoring was conducted across five consecutive years for the Pecos bluntnose shiner (*Notropis simus pecosensis*), a federally threatened minnow. Temporal changes in allele frequencies at seven microsatellite DNA loci were used to estimate variance effective size (N_eV) across adjacent years in the time series. Likewise, effective size was computed using the linkage disequilibrium method (N_eD) for each sample. Estimates of N_e were then compared to estimates of adult fish density obtained from traditional demographic monitoring. For Pecos bluntnose shiner, density (catch-per-unit-effort), N_eV and N_eD were positively associated across this time series. Results for Pecos bluntnose shiner were compared to a related and ecologically similar species, the Rio Grande silvery minnow. In this species, density and N_eV were negatively associated, which suggested decoupling of abundance and effective size trajectories. Conversely, density and N_eD were positively associated. For Rio Grande silvery minnow, discrepancies among estimates of N_e and their relationships with adult fish density could be related to effects of high variance in reproductive success in the wild and/or effects of supplementation of the wild population with captive-bred and reared fish. The efficacy of N_e as a predictor of density and abundance may depend on intrinsic population dynamics of the species and how these dynamics are influenced by the landscape features, management protocols, and other factors.

2010-11-20 11:30:00 **Comparative Population Genetics of Two Gila River Cyprinids**

Pilger, Tyler, J. ¹, Turner, Thomas, F. ¹. (1-University of New Mexico, Department of Biology).

The upper Gila River basin in southwest New Mexico, USA is one of the few unimpounded drainage basins remaining in North America and provides a stronghold for a unique and largely endemic fish fauna. However, coincident with introduction of nonnative predators, distributions of native fishes have severely declined. Reaches with high predator densities could inhibit dispersal of native fishes, disrupt migration corridors, and isolate populations by reducing gene flow and decreasing genetic diversity. We used microsatellite loci to examine population structure of two cyprinids with similar life history strategies, but with different current distributions. Spikedace, *Meda fulgida*, is a federally listed species that is found in only a few sites in the Gila River of New Mexico, whereas longfin dace, *Agosia chrysogaster*, is common and widely distributed. We collected fin clips from spikedace and longfin dace at three and seven localities, respectively, over a 96 km longitudinal section of the Gila River of New Mexico. We compared population substructure of the rare spikedace with that of the common longfin dace. Both species showed similar observed and expected heterozygosity. Although F_{ST} of both species indicated significant genetic structure between upstream and downstream sites, the more common longfin dace showed less genetic structure than the rare spikedace, suggesting there is more gene flow between reaches with longfin dace than spikedace. Preliminary data indicate that genetic divergence most likely results from isolation by geographic distance. Future work will examine the possibility that gene flow is disrupted by other abiotic or biotic factors related to habitat suitability and/or negative effects of predation.

2010-11-20 11:45:00 **Genetic diversity of non-native fishes exceeds natives in the Pecos River, NM**

Diver, Tracy ¹, Osborne, Megan ¹, Turner, Thomas ¹. (1-University of New Mexico Department of Biology).

Within New Mexico, the Pecos River supports a diverse community of fishes compared to other arid-land streams in the southwestern US. Relatively high alpha diversity results from an intact native fish fauna coupled with non-native species. We assessed nucleotide diversity for three native and two introduced fishes at the protein-encoding mtDNA ND4 gene. Contrary to expectation, diversity (as measured by π) was higher for recently introduced species *Notropis girardi* and *Hybognathus placitus* compared to native *Macrhybopsis aestivalis*, *Notropis jemezianus*, and *Notropis simus pecosensis*. We tested whether increased levels of genetic diversity in non-natives resulted from multiple introductions from genetically divergent sources. In this study, samples from the introduced Pecos River population of *N. girardi* were compared to samples collected throughout the native range in New Mexico and Oklahoma. Nucleotide sequence data indicated that the Canadian River is the likely source population of the introduced population and that introduced individuals harbor nearly all genetic variation present at the source population. Increased genetic diversity may allow non-natives to persist and thrive despite presumed local adaptation and competitive advantage of natives.

12:00-13:00 LUNCH

GENERAL SESSION 6: Moderator— Brandon Albrecht

2010-11-20 13:00:00 **2010 Area report for Nevada**

Weissenfluh, Darrick ¹, Miscow, Eric ², Hobbs, Brian ³, Sjoberg, Jon ³, Byrne, Cody ³, Petersen, Jeff ³, Pepper, Mark ⁴. (1-U.S. Fish and Wildlife Service, 2-Nevada Natural Heritage Program, 3-Nevada Department of Wildlife, 4-Great Basin National Park).

Brief updates on the population status and management of key Nevada native aquatic taxa are presented. The U.S. Fish and Wildlife Service is currently constructing the Amargosa Pupfish Research Station in Ash Meadows National Wildlife Refuge to provide for propagation of redundant populations of the endangered Devils Hole pupfish, *Cyprinodon diabolis*, in an artificial refuge, and for research support. Also in Ash Meadows, populations of two endangered fish species, Ash Meadows Amargosa pupfish, *Cyprinodon nevadensis mionectes*, and Ash Meadows speckled dace, *Rhinichthys osculus nevadensis*, were monitored in November 2009. The population estimates for both species declined from the last estimates in 2007. The U.S. Fish and Wildlife Service completed a 5 year review of *C. n. mionectes*, and concluded that no change in the listing status was warranted. In the Muddy River Warm Springs complex, ongoing restoration projects and eradication efforts of non-native blue tilapia, *Oreochromis aureus*, continue to increase suitable habitat for the endangered Moapa dace, *Moapa coriacea*; the most recent population surveys in August have revealed an increase from the low counts of 2008. In eastern Nevada, the endangered Clover Valley speckled dace, *Rhinichthys osculus oligopus*, was surveyed for the second year in a row by NDOW to monitor and evaluate population status. The once thought-to-be extirpated Diamond Valley speckled dace, *Rhinichthys osculus ssp.*, may still be extant; a survey effort by NDOW this past summer found two populations of dace in the Pluvial Lake Diamond. Tissue samples are being examined to determine lineage. In addition to species updates, restoration efforts that enhance habitats for the threatened desert dace, *Eremichthys acros*, threatened Railroad Valley springfish, *Crenichthys nevadae*, endangered White River spinedace, *Lepidomeda albivallis*, and Wall Canyon sucker, *Catostomus sp.*, are discussed. Through successful partnerships with tribal, state, and federal agencies, as well as private landowners, habitat and numbers of *C. nevadae*, and Dixie Valley tui chub, *Siphateles bicolor ssp.*, were improved. Additionally, cooperative efforts prevented the Amargosa toad, *Anaxyrus nelsoni*, from becoming listed as the 12 month finding by U.S. Fish and Wildlife Service found it “Not Warranted”.

2010-11-20 13:15:00 **Lake Mead razorback sucker recruitment, population trends, and relationships to recovery**

Albrecht, Brandon ¹, Holden, Paul ¹, Kegerries, Ron ¹, Rogers, Ron ¹. (1-Bio-West, Inc. Fisheries Section).

An ongoing razorback sucker (*Xyrauchen texanus*) research project on Lake Mead, Arizona and Nevada has been funded by the Southern Nevada Water Authority and the U.S. Bureau of Reclamation for 14 years. This study continues to document the presence of actual, wild razorback sucker recruitment in the form of young, sexually immature individuals. Continued recruitment denotes that the Lake Mead razorback sucker population is an anomaly in terms of razorback sucker persistence throughout the Colorado River drainage, despite similar non-native fish composition and densities as other locations. Fin ray aging data and back-calculation techniques have indicated that recruitment of razorback sucker in Lake Mead has occurred nearly every year since the 1970s. Cover features within Lake Mead appear to be responsible for this continued recruitment. The continued observation of natural razorback sucker recruitment has spurred recent interest in Lake Mead in terms of recovery populations/goals. Recovery goal discussions tend to center around population numbers and as such, we present the best available information depicting current population trends associated with Lake Mead razorback sucker. Continued monitoring efforts on Lake Mead should help to ascertain if recruitment events continue, to better understand the overall population size, and to help more fully understand how to enable this unique trend in other locations within the historic range of the species.

2010-11-20 13:30:00 **Razorback sucker at the Colorado inflow of Lake Mead: lessons from the past and looking to the future**

Kegerries, Ron ¹, Albrecht, Brandon ¹, Holden, Paul ¹. (1-Bio-West, Inc. Fisheries Section).

Efforts to locate razorback sucker (*Xyrauchen texanus*) and document recruitment on Lake Mead have been ongoing for the past 14 years. Previous studies indicate that razorback sucker tend to aggregate and spawn near inflow areas throughout the lake and suggest that cover in the form of turbidity and/or inundated vegetation perhaps aid in successful recruitment. Based on these past studies and recommendations brought before the Lake Mead Razorback Sucker Workgroup, efforts to locate razorback sucker in the Colorado Inflow of Lake Mead commenced in 2010. Methods including sonic telemetry, larval sampling, and trammel netting were used to assess the presence or absence of razorback sucker in this understudied area of Lake Mead. In total three adult and seven larval razorback sucker were collected documenting the presence of razorback sucker in the Colorado Inflow area of Lake Mead. Lessons learned from previous efforts allowed for early success in this endeavor; however, there is still much to be studied and questions to answer regarding this unique population. The methods employed during this study and the knowledge gained from previous studies on razorback sucker in Lake Mead may have implications basin-wide for this endangered sucker.

2010-11-20 13:45:00 **Conservation genetics of Lahontan tui chubs in Walker Lake, Nevada**

Finger, Amanda J ¹, May, Bernie ¹. (1-University of California, Davis).

Lahontan tui chubs in Walker Lake have experienced declines in recruitment as total dissolved salts (TDS) have increased over the last century. Here we investigate how genetically distinct the population in Walker Lake is relative to populations throughout the Walker, Carson and Truckee river basins. Using nine microsatellite markers, we found that the population of tui chubs in Walker Lake is genetically distinct and has robust genetic diversity. In addition we found that Walker Lake and Pyramid Lake populations are closely related despite being in different watersheds. This suggests that, since the recession of Lake Lahontan, Walker Lake and Pyramid Lake have supported large tui chub populations in the past while smaller populations have undergone drift which has reduced genetic diversity.

2010-11-20 14:00:00 **Unexpected benefits of the July 2010 Warm Springs wildfire for recovery actions for the endangered Moapa dace, *Moapa coriacea*.**

Syzdek, David J. ¹, Hobbs, Brian M. ². (1-Southern Nevada Water Authority, 2-Nevada Department of Wildlife).

The Moapa Warm Springs in southern Nevada is a regional spring complex that is the headwaters of the Muddy River. These naturally-thermal springs and associated streams are habitat for an endemic suite of thermophilic aquatic species that includes the federally endangered Moapa dace (*Moapa coriacea*).

Currently, the Southern Nevada Water Authority (SNWA) and stakeholders are undertaking recovery actions for the Moapa dace and its habitat. These include construction of fish barriers, reduction in or removal of non-native and invasive species, riparian and aquatic habitat restoration, and development of an ecological model for the Moapa dace. To facilitate recovery of the dace and other native species, SNWA purchased the 1,218-acre Warm Springs Ranch in September 2007 and designated it the Warm Springs Natural Area for conservation and environmental stewardship purposes. However, soon after the property's acquisition by SNWA, Moapa dace numbers declined to their lowest levels ever recorded. Working with the US Fish and Wildlife Service (USFWS), Nevada Department of Wildlife (NDOW), and the US Geological Survey, SNWA is conducting stream restoration work and intensive habitat improvements to reverse the population's decline. Following their nadir in February 2008, dace numbers began to increase, but a human-caused wildfire on 1 July 2010 burned over 600 acres of woodland near many of the streams that contain dace. Despite initial fears that Moapa dace would suffer catastrophic declines from the fire, post-fire fish surveys indicate a continued upward trend in dace numbers. In fact, the fire cleared enough non-native riparian vegetation to allow NDOW to treat a section of the Muddy River with rotenone to control the invasive and predatory blue tilapia (*Oreochromis aureus*) one year ahead of schedule. Furthermore, post-fire clearing of dense stands invasive tamarisk (*Tamarix spp.*) and fan palms (*Washingtonia spp.*) will facilitate the control of these non-native species and will aid in the re-establishment of native riparian vegetation.

2010-11-20 14:15:00 **Genetic Status of San Felipe Gambusia**

Echelle, Anthony A. ¹, McClure-Baker, Sherri ², Lozano-Vilano, Lourdes ³, Garrett, Gary P. ⁴, Edwards, Robert ⁵. (1-Oklahoma State University, 2-Dexter National Fish Hatchery and Technology Center, 3-Universidad Autonoma de Nuevo Leon, 4-Texas Parks and Wildlife Department, 5-The University of Texas-Pan American).

The San Felipe Gambusia *Gambusia clarkhubbsi* was described in 2003 from San Felipe Creek, a tributary of the Rio Grande in south Texas. The species differs from its closest relative, Spottfin Gambusia *G. krumholzi* in various features of pigmentation. *Gambusia clarkhubbsi* was unknown until 1997, when it first appeared in collections from San Felipe Creek. We used variation in mtDNA (cytb; 400 bp) and six microsatellite loci to assess the distinctiveness of the two species. For mtDNA, *G. clarkhubbsi* had a single haplotype that was present in 95% of 100 *G. krumholzi* from seven populations. Microsatellite diversity was slightly lower in 2 samples of *G. clarkhubbsi* (N = 37 and 38; $H_e = 0.28$) than in the 7 collections of *G. krumholzi* (N = 12-14; $H_e = 0.28$ vs 0.33-0.39). No loci was diagnostic of the two species, but, in a PCA plot based on microsatellites, the scatter of *G. clarkhubbsi* individuals showed no overlap with a tight cluster of individuals from the 7 population samples of *G. krumholzi*. Correspondingly, AMOVAs based on F_{ST} and R_{ST} attributed, respectively, 26% and 77% of total diversity to differences between the two species. Based strictly on molecular genetics, the San Felipe Gambusia qualifies as a distinct management unit within the *G. krumholzi* complex.

2010-11-20 14:30:00 **Evaluation of an artificial refuge designed to conserve multiple thermophilic aquatic species.**

Weissenfluh, Darrick S. ¹, Wilde, Gene R. ², Baldino, Cristi R. ¹. (1-U.S. Fish and Wildlife Service, 2-Texas Tech University).

A refuge may consist of natural or artificial habitat and is one tool managers of imperiled aquatic species commonly use to prevent species from becoming extinct. Most refuges are created to conserve a single species and sometimes multiple species of the same taxa. However, in rare situations, refuges are created to conserve multiple species of different taxa. School Springs is located in the Warm Springs Complex (WSC) of Ash Meadows National Wildlife Refuge, Nevada and was modified into an artificial refuge in 1983 to conserve a single endangered fish species, the Warm Springs pupfish, *Cyprinodon nevadensis pectoralis*. In 2008, the U. S. Fish and Wildlife Service renovated School Springs refuge and made it a multi-species refuge to conserve multiple thermophilic aquatic taxa including *C. n. pectoralis* and three WSC endemic aquatic invertebrates: the Ash Meadows Warm Springs naucorid *Ambrysus relictus*, Devils Hole Warm Springs riffle beetle *Stenelmis calida calida*, and median-gland Nevada springsnail *Pyrgulopsis pisteri*. School Springs refuge was designed to meet the habitat requirements of all four species so that a self-sustaining population of each species would persist. From 2009-2010, we conducted 28 bimonthly *C. n. pectoralis* surveys and 15 monthly endemic aquatic invertebrate surveys based on a stratified (habitat) random sampling design. All life stages of *C. n. pectoralis* utilize pool habitat more than any other habitat type, whereas all three endemic aquatic invertebrates primarily utilize spring-source and riffle habitat in the upper 20 meters of School Springs refuge. As of September 2010, all four species have reproduced and continue to persist in the refuge. Based on these results, design of the School Springs refuge appears to have succeeded in meeting the habitat needs of this diverse assemblage of imperiled aquatic organisms.

2010-11-20 14:45:00 **Evaluating the genetic purity of relict dace populations in the central Great Basin**

Houston, Derek D. ¹, Evans, R. Paul, Shiozawa, Dennis K. (1-Brigham Young University, Department of Biology, 2-Brigham Young University, Department of Microbiology & Molecular Biology, 3-Brigham Young University, Department of Biology).

The relict dace, *Relictus solitarius*, is a Great Basin endemic minnow restricted to a few spring systems within the Butte, Goshute, Ruby, and Steptoe basins in eastern Nevada. These aquatic habitats are remnants of pluvial lakes that filled those basins during the Pleistocene. *Relictus solitarius* is the only native fish in these basins, but speckled dace, *Rhinichthys osculus*, has been introduced into some of the localities. We used mitochondrial DNA (mtDNA) sequence data in an attempt to determine if four putative relict dace populations in Ruby Valley share mitochondrial haplotypes with speckled dace. Shared mitochondrial haplotypes could result from introgression of the mitochondrial genome following hybridization between the two species. Preliminary results of phylogenetic analyses show that relict dace mtDNA sequences from the Ruby Valley populations are more closely related to speckled dace than to relict dace, suggesting that mitochondrial introgression has occurred.

2010-11-20 15:00:00 **The use of backwaters and the conservation plan for native fishes of the lower Colorado River**

Kesner, Brian R. ¹, Marsh, Paul C. ¹, Dowling, Tom ². (1-Marsh & Associates, 2-Arizona State University).

Use of backwater or off-channel environments free of nonnative fishes is a central component of conservation plans for bonytail *Gila elegans* and razorback sucker *Xyrauchen texanus* in the lower Colorado River and the current focus of efforts on behalf of these species within the multi-agency long-term Lower Colorado River Multi-Species Conservation Program (LCRMSCP). As part of a larger study to investigate ecological and genetic factors involved in the success of the conservation strategy, two backwaters on Lake Mohave, Arizona-Nevada, were each stocked with 200 PIT tagged and fin

clipped razorback sucker in February, 2010. Fish were allowed to grow and reproduce, and were harvested in September, 2010. Survival for stocked fish was greater than 75% and more than 1,000 young-of-year razorback sucker were produced in each backwater. The experiment is presented as an example of how off-channel habitats free of nonnatives can work, although larger applications of this technique to date have been wrought with logistic hurdles and agency intransigence.

GENERAL SESSION 7: Moderator—Trina Hedrick

2010-11-20 15:15:00 **Status and management of the native fishes of the Upper Colorado Basin**

Hedrick, Trina N. ¹, Brandenburg, W. Howard ², Farrington, Michael A. ². (1-Utah Division of Wildlife Resources, 2-American Southwest Ichthyological Resources, L.L.C.).

Activities continue in an effort to improve the status of many of the native fishes of the Upper Colorado River Basin. These activities are guided principally by four programs: the Upper Colorado River Endangered Fish Recovery Program (UCRRP), the San Juan River Basin Recovery Implementation Program, the range-wide Conservation Agreement for the Colorado River cutthroat trout, *Oncorhynchus clarkii pleuriticus*, and the Range-wide Conservation Agreement and Strategy for the roundtail chub, *Gila robusta*, bluehead sucker, *Catostomus discobolus*, and flannelmouth sucker, *C. latipinnis*. The two recovery programs (which work specifically towards recovery of the Colorado pikeminnow, *Ptychocheilus lucius*, and razorback sucker, *Xyrauchen texanus*, and also the bonytail, *G. elegans*, and humpback chub, *G. cypha* in the case of the UCRRP), use the protection of instream flow, habitat restoration, nonnative fish control, propagation, life history monitoring, and information and education to bring benefits to the four “big river fishes.” Examples of recent efforts include continued research into the use of floodplain habitats by razorback sucker and increased effort towards removal of problematic nonnative species. Renovation of rainbow trout streams and reintroduction of the Colorado River cutthroat trout continues in Colorado, Utah, and Wyoming. Additional locations continue to be targeted for barrier placement and cutthroat reintroduction. Research into the movement and life history needs of the roundtail chub, bluehead sucker, and flannelmouth sucker continues in many locations in the upper basin.

2010-11-20 15:30:00 **Effects of a Single Grazing Event by Cattle on Terrestrial Invertebrates Falling Into Streams and Trout Populations: Results of a Field Experiment**

Saunders, W. Carl ¹, Fausch, Kurt D. ². (1-Utah State University, 2-Colorado State University).

Recent research has shown that terrestrial invertebrates are important prey resources for trout, often providing about 50% of their annual energy and having strong effects on growth and abundance. However, the importance of this prey resource in rangeland streams has received little attention, and there has been no experimental test of whether riparian grazing by livestock reduces this important prey resource. During summer 2008, we conducted a field experiment to test whether cattle grazing alone, or grazing and manual removal of woody riparian vegetation, affect trout populations by reducing terrestrial invertebrate prey in arid Wyoming streams. We tested three, short duration (2 – 11 d), grazing treatments: 1) moderate intensity grazing (10-15 cm stubble height), 2) high intensity grazing (5-7.5 cm stubble height), 3) high intensity grazing plus removal of two-thirds of streamside woody vegetation, and 4) a control with no livestock grazing. Overall, short durations of moderate and high intensity grazing had little effect on terrestrial invertebrates entering streams, but grazing plus removal of streamside woody vegetation caused significant reductions in terrestrial invertebrate inputs to streams. In contrast, all experimental treatments reduced the biomass of terrestrial invertebrates in late-summer trout diets. However, these effect did not translate to reductions in trout populations. These results indicate that terrestrial invertebrates falling into streams may be relatively resistant to short, but intensive, bouts of grazing, and that grazing systems that incorporate short grazing bouts and maintain streamside woody vegetation, may also support the terrestrial prey resources necessary to sustain robust trout populations.

2010-11-20 15:45:00 **Greenback Cutthroat Trout in the Colorado River Basin: The original homestead?**

Evans, R. Paul ¹, Shiozawa, Dennis K. ², Unmack, Peter ², Mathis, Jason ². (1-Department of Microbiology and Molecular Biology, Brigham Young University, 2-Department of Biology, Brigham Young University).

Cutthroat trout, *Oncorhynchus clarkii*, comprise at least 14 subspecies in western North America. The subspecies are typically found in geographically isolated drainages. Efforts to restore some of the most seriously threatened or endangered Cutthroat trout subspecies are required as the result of introgression, predation, and competition from introduced trouts as well as general habitat degradation. These impacts have clouded the original distribution and origins of the multiple subspecies. We present data and analyses based on sequence of half the mitochondrial genome covering multiple genes. Three main groupings were found. One group formed a basal cluster consisting of *O. c. clarkii*, Coastal Cutthroat Trout, *O. c. henshawi*, Lahontan Cutthroat Trout, and *O. c. lewisi*, Westslope Cutthroat Trout. The remaining two groups are sister lineages. One consists of *O. c. bouvieri*, Yellowstone Cutthroat Trout and *O. c. utah*, of the Bear River Basin of Utah and Idaho (Bear River Bonneville Cutthroat Trout). The other lineage consists of *O. c. pleuriticus*, Colorado River Cutthroat Trout, *O. c. stomias*, Greenback Cutthroat Trout, *O. c. virginalis*, Rio Grande Cutthroat Trout and *O. c. utah*, Bonneville Cutthroat Trout. We found moderate to strong resolution between the three lineages, but mostly poor resolution within each lineage. To clarify the biogeographical history of Greenback cutthroat trout, the mtDNA sequences of multiple genes were also analysed for Greenback Cutthroat trout populations from the east and west side of the Continental Divide. The greatest amount of sequence diversity was discovered in the Colorado River Basin populations as compared to the Arkansas or South Platte populations. These data suggest that Greenback Cutthroat trout recognized on the east side of the Continental Divide originated in the Colorado River basin and that the Greenback Cutthroat populations in the Colorado River basin are native. Colorado River Cutthroat trout were further examined to help resolve their possible origin in the northern Colorado River basin.

2010-11-20 16:00:00 **Restoring the San Rafael River**

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Nine native fish species inhabit the San Rafael drainage including the sensitive Flannelmouth sucker, *Catostomus latipinnis*, Bluehead sucker, *Catostomus discobolus*, , Roundtail chub, *Gila robusta*, , and the Colorado River cutthroat trout, *Oncorhynchus clarkii pleuriticus*, . Additionally the endangered Colorado pikeminnow, *Ptychocheilus lucius*, , Razorback sucker, *Xyrauchen texanus*, , and Bonytail, *Gila elegans*, , inhabit the lower half of the river. With the exception of the Colorado River cutthroat trout, these sensitive and endangered fishes can be found in the San Rafael River. The San Rafael drainage is a perturbed ecosystem impacted by land and water use and nonnative species. Frequent dewatering, degraded instream habitat and

fragmentation of the drainage have resulted in reduced abundances and ranges of native fish. Due to the presence of these fish, the threats posed to them and the high potential for a successful restoration, this drainage ranks among the highest in importance to native fish in Utah. Although the opportunity for a successful restoration is high, the process remains difficult due to complex ecological interactions, competing interests in the drainage and over allotted water resources. The drainage wide scale and complexity of this project prompted the assembly of the San Rafael Restoration Committee to guide restoration efforts, provide technical assistance, and assure that all user groups are represented. Due to funding availability and the obvious effects of tamarisk, *Tamarix ramosissima*, infestation, removal and revegetation efforts were initiated in riparian and floodplain habitats on three properties owned by the Utah Division of Wildlife along the lower San Rafael River. Currently tamarisk removal has been completed on 752 acres and an additional 298 acres will be treated beginning this winter. Removal and re-vegetation efforts will continue on state owned lands and will likely expand onto BLM property in the future. The first task undertaken by the restoration committee was the drafting of a conceptual restoration plan that contained background information about the drainage, a project goal, and objectives and strategies for meeting the goal. During the drafting of the restoration plan it was determined that more information about the drainage was needed to guide restoration efforts. Fish, bird, bat, and vegetation surveys were initiated in the restoration area to track changes associated with the restoration efforts and establish baseline data. Additionally studies to determine movement patterns and habitat needs of native fish and to determine the history of geomorphologic change and assess the effectiveness of tamarisk removal were begun. The Hatt Ranch diversion was identified as a barrier preventing fish movement into the upstream half of the river and restoring connectivity is an objective in the restoration plan. Several potential solutions were devised to address this problem and a geologic study was contracted to determine the pre-dam location of the river to meet data needs. Currently channel restoration and dam removal is being considered however this portion of the project will not be addressed until a viable nonnative control plan is devised to prevent further nonnative fish invasion into the upper drainage. With the exception of the geologic survey, the above projects are ongoing. The current focus of the restoration project is to determine the minimum flows required to support viable populations of native fish throughout the river. Following this study, strategies to meet these recommendations will be explored. Hydraulic modeling of the drainage currently being conducted by Emery County may identify inefficiencies in water management and delivery that may be used for native fish. Future projects will focus on restoring connectivity throughout the drainage, nonnative control, and achieving flow recommendations.

2010-11-20 16:15:00 Long-distance movements by Flannelmouth Sucker in big river habitats

Breen, Matthew J. ¹, Hedrick, Trina N. . (1-Utah Division of Wildlife Resources).

Flannelmouth Sucker (*Catostomus latipinnis*) is currently listed as a Tier I Sensitive Species in Utah due to reductions in their historical range. Although recent investigations indicate that viable, self-sustaining Flannelmouth Sucker populations persist in the Green and White rivers of Utah, relatively little is known about their movement patterns in this large un-impounded section of the upper Colorado River basin. From 2007-2009, we marked a total of 3,058 Flannelmouth Suckers with Passive Integrated Transponder (PIT) tags throughout the Green (314 continuous river km [RK]) and White (107 continuous RK) rivers. Spring (April-June) and summer (July-August) electrofishing surveys from 2008-2010 yielded 71 Flannelmouth recaptures. Mean movement distance was 61.0 ± 9.0 km (range = 0 – 360 km), where movements were positively associated ($rS = 0.355$; $P = 0.003$; $N = 71$) with Flannelmouth total length (433.1 ± 7.7 mm; range = 196 – 507 mm). Inter-drainage movements were detected by seven Flannelmouth; five fish migrated from the Green into the White River in spring, one fish making the same movement in summer, and one fish traveled from the White into the Green River in summer. Movement into the White River occurred from below (six fish) and above (one fish) the confluence. Forty-one percent of recaptures moved downstream, 72% doing so in spring, and 58% moved upstream, 75% in the spring. However, there was not a significant difference in movement distance by season ($U = 433$; $P = 0.432$; $N = 71$) or direction ($U = 562$; $P = 0.703$; $N = 70$). Additionally, we observed substantial within-season movement (i.e., tagged and recaptured in spring) in the downstream direction (mean distance = 124.9 ± 35.6 km; movement rate = 10.5 ± 3.2 km/day). Our results indicate that Flannelmouth Suckers are highly migratory, with a maximum recorded movement distance of 360.0 km; the longest movement documented for this species to our knowledge. Given the timing and extent of observed movements, as well as size-related movements, we hypothesize that Flannelmouth in big river habitats maintain summer home ranges that are widely separated from distinct spring spawning areas. However, the timing of spawning migrations likely differs greatly by metapopulation. Flannelmouth Suckers utilized large portions of the upper Colorado River basin, including multiple drainages, which is likely an important factor for successful recruitment by this species.

2010-11-20 16:30:00 The Changing Geomorphic Template of Native Fish Habitat of the Lower San Rafael River, Utah

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The physical template of the aquatic ecosystem of the lower San Rafael River changed drastically during the 20th century. Today, the lower San Rafael River still provides patches of complex habitat for roundtail chub, *Gila robusta robusta*, flannelmouth sucker, *Catostomus latipinnis*, and bluehead sucker, *Catostomus discobolus*. Early 20th century photos show a wide, laterally unstable channel and a floodplain that is relatively low and was probably frequently inundated by overbank flows. 1938 aerial photographs also depict a complex, multiple thread, baseflow channel with numerous bars. During the subsequent 60 years, the channel simplified into a single-thread with low width-to-depth ratio. As a result of narrowing, the current channel contains few riffles and is only connected to the floodplain during rare, large floods. Aquatic habitat complexity is reduced. Three factors caused these changes in channel geomorphology: (1) reduced magnitude and duration of the spring snowmelt flood, (2) dense establishment of tamarisk (*Tamarix spp*) throughout the alluvial valley, and (3) continued supply of fine sediment from ephemeral tributaries. We determined the degree and rate of geomorphic change and thus change in aquatic habitat by analyzing spatially-rich data extracted from aerial photographs. Results show that a 10-km reach near Hatt Ranch narrowed 62% during a 44-year period. Analysis of temporally precise data measured at USGS gage 09328500 between 1949 and 1970, shows that the channel cross-section narrowed by 60% and incised its bed approximately 1.2 m. Rating relations since the 1980's provide corroborative evidence that channel narrowing and reduction in channel capacity continues; today, parts of the channel bed are on bedrock, thereby preventing further incision. We evaluated floodplain formation and channel narrowing processes by interpreting stratigraphy in floodplain trenches and dated these alluvial deposits using dendro-geomorphic techniques. We correlated changes in the flow regime with episodes of aggradation, thus determining the role of flood reduction in narrowing the channel. Stratigraphy observed in a 40-m long trench on Hatt Ranch demonstrates that the channel narrowed primarily by the deposition of sediment inset within the channel during the 1960's and 1970's. Dendrogeomorphic results verify that inset deposition is still occurring.

2010-11-20 16:45:00 **Population Estimate of Humpback Chub, *Gila cypha*, and Roundtail Chub, *Gila robusta*, in Westwater Canyon, Colorado River, Utah, USA, 2007-2008**

Elverud, Darek ¹. (1-Utah Division of Wildlife Resources).

Westwater Canyon on the Colorado River in eastern Utah contains the largest of the five remaining populations of endangered humpback chub, *Gila cypha*, in the upper Colorado River Basin. Westwater Canyon also contains a large population of roundtail chub, *Gila robusta*, which are listed as a species of concern throughout their range. Multiple pass population estimates of sympatric adult humpback chub and adult roundtail chub were calculated in 2007 and 2008 and have been calculated periodically in Westwater Canyon since 1998. Fishes were captured via trammel nets and cataraft mounted electrofishing and were implanted with PIT tags upon initial capture. Three sampling trips were completed in both 2007 and 2008. Closed-capture population estimates for adult humpback chub indicate significant decrease in the population from 1998, but no significant differences were found between the 2007-2008 sampling period and years after 1998. Trammel net catch per unit effort (CPUE) likewise show significant decrease in catch rate of adult humpback chub from 1998 and years prior to 1998, but exhibit no significant decrease from years after 1999. Adult roundtail chub population estimates and CPUE metrics alternately did not show significant change over time.