2012-11-15 09:00:00 **In the fullness of time: Considering the value of rare and endangered desert fishes**

Norment, Christopher[*1]. (1-College at Brockport, SUNY).

Four taxa of pupfish (*Cyprinodon*) in the Death Valley region currently are listed under the federal Endangered Species Act; another taxon, the Tecopa pupfish (*C. nevadensis calidae*), is extinct. Efforts to protect the listed pupfish taxa sometimes involve "extraordinary" measures, as with the Owens pupfish (*C. radiosus*)and the Devil's Hole pupfish (*C. diabolis*). In the case of the Owens pupfish, habitat loss and impacts of invasive species have led to the repeated extinction or decline of populations in refugia, necessitating continued efforts to establish and maintain new populations; the California Department of Fish and Game database contains records of 40,482 pupfish handled during 143 translocations. Efforts to sustain the Devil's Hole pupfish have included intensive monitoring, supplemental feeding, attempts to establish populations in refugia, and the recent construction of the four-five million dollar Ash Meadows Fish Conservation Facility. At the same time, climate change and increasing demand for water in the region may increase the vulnerability of some pupfish populations. Given the potentially perilous status of many pupfish populations, and the resources that may be required to sustain these populations, it is important to articulate convincing arguments for conservation of pupfish and other vulnerable taxa, which will resonate with the general public, conservation biologists, and resource managers. My field and creative writing project, *In the Fullness of Time*, represents one attempt to do so; it asks how the interests of pupfish and people are linked, and includes what I term a "metaphorical" argument for preserving endangered species: that the stubborn, continued existence of organisms in harsh and unforgiving environments can encourage us, and fill us with wonder.

2012-11-15 09:15:00 **Nevada Area Report**

Miskow, Eric[*1], Baldino, Cristi[2], Simons, Lee[2], Crookshanks, Chris[3], Guadalupe, Kevin[3], Petersen, Jeff, Goodchild, Shawn[4]. (1-Nevada Natural Heritage Program, 2-U.S. Fish & Wildlife Service, 3-Nevada Department of Wildlife, 4-North Dakota State University).

A summary, overview and status of Nevada's desert fishes, current research and management projects in the state are addressed. Nevada waters contain 16, endangered and 6 threatened species of fishes as well as numerous undescribed taxa. Moapa dace, *Moapa coriacea* , have increased in numbers over the past year in response to habitat improvements and ongoing removal of exotic competitors/predators. The estimated population is 1,181 (up from 713 a year ago). Efforts continue to ensure that blue tilapia are gone from Warm Springs and are eradicated further downstream. Fish barriers are being removed or re-built to facilitate demographic connectivity between breeding habitat (springheads) and holding habitat downstream (larger outflows). Bureau of Land Management will build two additional pass-through barriers in 2012 downstream from the Warm Springs area to benefit native Virgin River chub, *Gila seminuda* , Moapa speckled dace, *Rhinichthys osculus moapae*, and indirectly Moapa dace as well. Threats include red shiner, *Cyprinella lutrensis*, red swamp crayfish, *Procambarus clarkia*, and Ictalurids in the lower river. In far eastern Nevada, habitat restoration in ongoing for remnant populations of the relict dace, *Relictus solitaries*, in the southern portion of the Ruby Valley National Wildlife Refuge. The creation of more suitable habitat as well as a rotenone application for removal of nonnatives and relict dace/speckled dace, *Rhinichthys osculus* ssp. hybrids is scheduled for early autumn. Continued habitat enhancements for the undescribed Wall Canyon sucker, *Catostomus* sp. in northeastern Nevada has been ongoing in the form of crayfish removal. As non-native brown trout, *Salmo trutta* as well as signal crayfish, *Pacifastacus leniusculus*, continue to heavily impact the Wall Canyon sucker. In concert with the United States Geological Service (USGS), the Department of Wildlife received a grant from the Desert Fish Habitat Partnership to construct a fish movement barrier on Mountain View Creek in an effort to prevent or hinder the invasion of nonnative brown trout and signal crayfish into the stream. A total of 104 Wall Canyon suckers were transplanted into Wall Canyon Creek from Mountain View Creek in the spring of 2010. In addition, trapping activities completed in both 2011 and 2012 were successful in the removal of 5,609 crayfish inhabiting the upper portion of Wall Canyon Creek. It is hoped that these measures will expedite the re-colonization of the stream by Wall Canyon suckers and hasten the recovery of the species. At the Ash Meadows National Wildlife Refuge, the restoration and rehabilitation of Longstreet and Rodgers Spring outflow channels is scheduled to begin in February of 2013. This will complete restoration of the major springs in the upper Carson Slough. A project to eradicate the red swamp crayfish, *Procambarus clarki*, at the South Scruggs Complex to create more preferable habitat for the Warm Springs Amargosa pupfish, *Cyprinodon nevadensis pectoralis*, is scheduled for this fall. The refuge has also purchased two additional land parcels including Five Springs which contain the Ash Meadows Amargosa pupfish, *Cyprinodon nevadensis mionectes*. In addition to these species updates, restoration efforts in central Nevada in Railroad Valley at both Lockes Ranch and the Duckwater tribal lands continues for the Threatened Railroad Valley springfish, *Crenichthys nevadae*, also updates on the Endangered Clover Valley speckled dace, *Rhinichthys osculus oligoporus*, and the Pahranagat river fishes will be discussed.

2012-11-15 09:30:00 **Transcriptome-based genetic marker development for non-model organisms**

Davis, Nicholas G.[*1], Page, Justin T.[1], Shiozawa, Dennis K.[1]. (1-Brigham Young University, Department of Biology).

Population genetic and phylogenetic research on non-model organisms has often been limited by having too few genes available. Next generation sequencing techniques are eliminating that barrier. Using transcriptomes in combination with Illumina sequencing technology, Trinity assembly software, custom PERL pipeline scripts, and Primer3 primer prediction software, we produced and analyzed 6 Ephemeropteran (Mayfly) and 7 Plecopteran (Stonefly) transcriptomes in an attempt to identify conserved homologous genetic markers. We found 61 homologous genes for the insect order Ephemeroptera and 79 homologous genes for the insect order Plecoptera. Primer sets designed using the homologous gene alignments will be validated using PCR on representatives for all families within their respective orders and the sequence data will be used to construct new phylogenies and evaluate previous ones. These primers represent an enormous increase in the marker set for these two orders of insects. These techniques are easily translatable for work on fishes and other aquatic fauna and will soon be applied in our lab to Western North American fishes, leeches, snails, and amphipods.

2012-11-15 09:45:00 **The current status of Eagle Creek, AZ and its changing fish community**

Warmbold, Jerry[*1], Marsh, Paul[1], Kesner, Brian[1]. (1-Marsh & Associates).

Eagle Creek, a tributary of the Gila River in Greenlee County, Arizona, is home to a diverse native and non-native ichthyofauna. Headwaters of this creek begin in the White Mountains, and continue 84 km to the Gila River confluence. Downstream from the mountains, the influence of anthropogenic disturbances such as cattle ranching and mining activities becomes apparent as flow decreases, with surface waters disappearing before reaching the Gila in some years. Its history, although rarely recorded, is filled with stocking events, fire, unexpected detection of endangered species, and the subsequently vanishing of said species. Since 1985, routine monitoring surveys have been conducted throughout warm water reaches of the creek. These surveys provide

invaluable insight into species demographics and fluctuations in presence and locations of native fish in response to not only natural disturbances such as fire, but unnatural, such as non-native fish introduction. Once home to as many as nine native species since 1987, including spikedace, *Meda fulgida*, and loach minnow, *Tiaroga cobitis*, only six of the original nine have been documented within the last decade. This paper explores the history of the Eagle Creek fish community from 1985 to present day, with special focus on dramatic events such as the Wallow Fire in 2011, and intermittent presence of vulnerable species.

2012-11-15 10:00:00 **Next generation sequencing and bioinformatics procedures identify single nucleotide polymorphisms capable of differentiating cutthroat trout subspecies**

Houston, Derek D.[*1], Elzinga, David B.[2], Maughan, Peter J.[2], Smith, Scott M. [2], Kauwe, John S. K. [1], Evans, R. Paul , Stinger, Ryan B. [2], Shiozawa, Dennis K. [1]. (1-BYU, Department of Biology, 2-BYU, Department of Plant and Wildlife Sciences, 3-BYU, Department of Microbiology and Molecular Biology).

Considerable genetic information has been generated for model organisms, such as Drosophila, zebra fish, and white mice. Conversely, non model taxa have received significantly less genetic study. Salmonid fishes are non model organisms for which single nucleotide polymorphism (SNP) discovery has been actively pursued in recent years. But as a group they still warrant additional research. The cutthroat trout (*Oncorhynchus clarkii*), comprised of ten extant subspecies, have diagnostic SNPs identified. for only some subspecies. Cutthroat trout and rainbow trout (*Oncorhynchus mykiss*) have been widely stocked throughout western North America, historically with little regard for geographic variation among subspecies. Hybridization with introduced trout has placed the genetic integrity of native cutthroat trout populations at risk. As efforts to evaluate the genetic composition of cutthroat trout populations has increased, the need for additional genetic markers has also increased. We used genome reduction, MID barcoding, and next generation sequencing (454 pyrosequencing) to discover SNPs that differentiate cutthroat trout subspecies. These provide a rapid, cost effective method to evaluate cutthroat trout populations.

2012-11-15 10:15:00 **Imperial ponds: A case study**

Ehlo, Chase[*1]. (1-Marsh and Associates, LLC).

The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) is a 50-year conservation program intended to address the biological needs of at least 26 species through implementation of its Habitat Conservation Plan. A component of the program is to develop off-channel locations focused on maintaining razorback sucker, *Xyrauchen texanus* and bonytail, *Gila elegans* genetic stock. In 2007, six ponds were established on Imperial National Wildlife Refuge, Arizona, and stocked with razorback sucker and bonytail. We carried out pond monitoring from 2007 to 2012 and focused on bonytail and razorback sucker abundance, growth, reproduction, and recruitment, and on habitat associations of resident razorback sucker. The project has had failures and successes. An adequate clean water supply and ponds devoid of non-native fishes have yet to be established. Despite this, both razorback sucker and bonytail survived, reproduced, and recruited in 2008 and 2011 in two of the six ponds. Although recruitment in 2008 was not properly estimated, one juvenile razorback sucker and more than 100 juvenile bonytail were captured between late 2008 and early 2009. An estimated 135 razorback sucker and at least one bonytail recruited in 2011 in the adjacent pond. These events followed consolidation of all native fish into a single pond with no non-native fish except western mosquitofish. The two ponds with recruitment also had the highest annual adult razorback sucker survival rates estimated at 83% and 87%. In contrast, post-stocking survival for razorback sucker in two other ponds ranged from 9% to 22%. With infrastructure changes and proper management actions Imperial Ponds will become an important conservation area that contributes to the persistence and recovery of razorback sucker and bonytail.

2012-11-15 10:30:00 **Mexico's Northeast Area Report**

Valdes Gonzalez, Arcadio[1]. (1-Facultád de Ciencias Biológicas, UANL).

With the assistance of Yolanda Castillo, the info has been updated and added to the page for the fishes of the region and the situation of most of them. We also have continued to seek for a better treatment for mycobacteriosis, finding an easy way to detect the presence of this pathogen, now we can check the fish by cloacal mucus or fish droppings imprints, to dry and stain for Ziehl Neelsen stain for Gram Positive bacteria, and locating them in most of places where the fish are threatened or endangered by habitat alterations, such as in Chichencanaab, Quintana Roo, in Durango and in Nuevo Leon. On other issue, by visiting Cuatrociénegas region, sadly, the water exploitation has continued, now they are changing the channels for deep 24 inch water pipes to drain the area of the Tia Tecla, at the East of the Valley. Besides that, the social instability seems to have been stabilized somewhat, there is a military post with soldiers at the entrance to the Valley. Otherwise, the person guarding the Area demands everybody to pay for the entrance and gives advice not collect anything to avoid possible conflicts. There seems to be no end to the quarrel in between the interested parties and most of the region is continued out of reach for visitors, but is still possible by developing all the paper work through SEMARNAT, the Sate, The City, and the National Commission for Protected Areas, the Ejidos leader, or the land owner respectively. The rest of the country continue about the same, it is in general somehow difficult to make the decision to go out and do field work, but it is relatively peaceful if you travel by day and never along, there seems to be all right with society and the roads, myself have see nothing wrong so far.

Con la asistencia de Yolanda Castillo, se ha actualizado la página de los peces del Noreste de México, y se han subido los datos disponibles para la mayoría de los peces de la zona. En nuestro Laboratorio hemos continuado buscando la mejor manera para darle tratamiento a la micobacteriosis, encontrando una forma fácil para detectar la presencia de este patógeno, ahora podemos checar si los peces son portadores al realizar improntas del mucus la región cloacal o de las excretas de ellos, al secar y teñir para Ziehl Neelsen para bacterias Gram Positivas, y lo hemos localizado en las localidades donde los peces se encuentran en peligro por la alteración del hábitat, como sucede en Chichencanaab, Quintano Roo, en Durango, y en Nuevo León. También, al visitar el Valle de Cuatrociénegas, tristemente vimos que la explotación del el agua del Valle ha continuado, ahora con los trabajos de convertir los canales de concreto a tubería profunda de PVC de 24 pulgadas drenando de la zona de la Tia Tecla por la región Oriental del Valle. Además de eso, la inestabilidad social parece haberse estabilizado de alguna manera, la entrada al Valle es vigilada por un puesto militar por soldados, muy amables y casi no molestan a nadie, solamente hacen su trabajo. Los vigilantes en la entrada al Área Protegida demandan el pago de la cuota para permitir la entrada, y advierten de no colectar nada para evitar conflictos. Igualmente, parece no existir un fin a la situación que generó que se cerrara el Valle a la mayoría de los visitantes, los intereses continúan en conflicto desafortunadamente, pero siempre es posible el proceder con los respectivos permisos, tanto de la SEMARNAT, del Estado, de la Comisión Nacional de Áreas Protegidas, del Alcalde de la Ciudad, del dirigente del Ejido o dueño de la propiedad respectivamente. El resto del país continúa aproximadamente igual, es difícil tomar la decisión de salir para realizar trabajo de campo, pero todo está relativamente en calma si se viaje de día y acompañantes, la sociedad y los caminos no representan ningún problema, al menos por lo que he visto personalmente, no existe nada malo o fuera de lugar.

2012-11-15 10:45:00 **Stream hierarchy defines riverscape genetics of a North American desert fish**

Douglas, Michael [*1], Douglas, Marlis[1]. (1-University of Arkansas Biological Sciences).

Global climate change is apparent within the southwestern deserts of North America, where record drought is reflected within the 640,000 km2 of the Colorado River. To discern the manner by which natural and anthropogenic drivers have compressed fish biodiversity, and to establish a baseline for future climate change effects, the Stream Hierarchy Model (SHM) was employed to juxtapose fluvial topography against molecular diversities of 1,092 Bluehead Sucker [*Catostomus (Pantosteus) discobolus*]. Microsatellite analyses (16 loci) subdivided the Colorado River Basin into seven management units (MUs). One is an admixed cline of three gene pools within mainstem and lower-gradient tributaries of the mainstem. Six others are distinct not only genetically but demographically (i.e., migrants/ generation

2012-11-15 11:00:00 **Demographic history and population structure of *Notropis suttkusi* in southeastern Oklahoma**

Schwemm, Michael R. [*1], Echelle, Anthony A.[1], Van Den Bussche, Ron A.[1]. (1-Oklahoma State University).

Recent phylogeographic analyses have shown that the Rocky Shiner *Notropis suttkusi* of southeastern Oklahoma and southwestern Arkansas represents a distinct clade of the widespread *N. rubellus* complex. This species is of conservation concern because of proposed water development projects on the Arbuckle aquifer. Our results are interpreted against the broader geographic perspective of previous genetic analyses and provide insight into conservation genetics for the species. Here, we present results from a population genetic analysis using complete sequences of the mitochondrial cytochrome b gene from five populations throughout the species' range. Results show large numbers of weakly divergent haplotypes (60 in 178 fish;

2012-11-15 11:15:00 **Connecting the dots: Integrating metacommunity and life history theories to enhance native fish conservation**

Gido, Keith[*1], Whitney, James[1], Turner, Thomas[2], Pilger, Tyler[2], Propst, David[2]. (1-Kansas State University, 2-Museum of Southwestern Biology).

We propose that integrating metacommunity and life history theories into a synthetic model will simplify predictions of key processes structuring stream fish communities. Metacommunity theory identifies three essential forces (environmental heterogeneity, dispersal, and biotic interaction) that drive patterns of stream fish community structure at the regional scale. The trilateral life history model of Winemiller and Rose (1992) predicts how species that vary along gradients of fecundity, parental investment, and age at maturity can be used to predict the propensity for species dispersal, responses to ecosystem stability, species interactions, and utilization of limited resources. Thus, synthesis of metacommunity and life history theories allows predictions of community responses to natural and human-caused environmental disturbance at the watershed scale. We use data from the upper Gila River, New Mexico to evaluate this approach and to infer critical areas of conservation for the imperiled fauna in this system. Empirical data are generally consistent with predictions based on our synthetic model, but specific anthropogenic influences to the system (e.g., nonnative species and habitat modification) explain deviations from predictions.

2012-11-15 11:30:00 **Does rarity constitute a threat under the Endangered Species Act?**

White, Rollie[*1], Allen, Christopher[1]. (1-USFWS).

Many endemic fishes in the American west are limited in numbers and distributions either by natural conditions inherent to their environment or directly or indirectly by human activities that have altered the ecosystems upon which these species depend. As a result of rarity, in combination with biological status and threats to their persistence, many species, subspecies or distinct population segments (hereafter species) have been afforded protection under the federal Endangered Species Act (ESA) of 1973 (Minckley and Deacon 1991). While most federal listings of fish in the American west were determined by an assessment of status and threats under the U.S. Fish and Wildlife Service's (Service) listing policy, the role and contribution of rarity was clearly a factor in many decisions. The federal designations as threatened or endangered provided legal protections for these species and their unique habitats and led to implementation of many recovery actions aimed most often at protection of the species' habitat through establishment of preserves or refuges. Despite decades of conservation gains since many of these fish were federally listed, none have been delisted under the ESA. One of the reasons most often supported for maintaining threatened or endangered status under the ESA despite many that have met downlisting or delisting recovery criteria, is the continued rarity of these species, even in the absence of threats. At a time when the Service's budget is in decline, it is important to demonstrate success of the ESA by showing the ability to recovery species by downlisting and delisting as appropriate. One example is Borax Lake chub (*Gila boraxobius*) in southeast Oregon, a fish the Service recently recommended for downlisting from endangered to threatened in a five-year status review for the species. Because the species is found only in Borax Lake it will always be rare. However, without an operative threat, a rare species is in no greater danger of extinction than a more widespread species. In the case of Borax Lake chub, a number of recovery actions have been implemented that significantly reduce threats to the species such that a change in listing status was determined to be warranted. With Borax Lake chub as a case study, this presentation will explore the role of threats and species rarity in the Service's listing and delisting process.

2012-11-15 11:45:00 **Diversity, biogeography, and conservation of aquatic animals in southern Sonoran Desert oases**

Bogan, Michael T.[*1], Noriega-Felix, Nohemi[2], Vidal-Aguilar, Sylvette[2], Findley, Lloyd T.[3], Lytle, David A.[1], Gutierrez-Ruacho, Oscar, Alvarado-Castro, Andres[2], Varela-Romero, Alejandro[4]. (1-Oregon State University, Department of Zoology, 2-Centro de Estudios Superiores del Estado de Sonora, 3-Centro de Investigacion en Alimentacion y Desarrollo- Unidad Guaymas, 4-Universidad de Sonora, Departamento de Investigacion Cientifica y Tecnologica).

The arid El Aguaje, Santa Ursula, and Bacatete mountain ranges in southern Sonora, México contain numerous canyons supporting spring-fed aquatic habitats, isolated from one another by formidable volcanic cliffs and vast expanses of desert. While the relict tropical vegetation in such canyons has been previously studied, their aquatic life forms have received very little attention. In this study, we mapped sites in these mountain ranges that support freshwater habitat, identified distinct microhabitat types at each site, and inventoried their aquatic biota. We identified eight sites with perennial freshwater in the Sierra El Aguaje in 2008 and an additional 11 sites in the sierras El Aguaje, Santa Ursula and Bacatete in 2009. These 19 sites supported more than

220 taxa of aquatic animals, with richness at individual sites ranging from 10 to 123 taxa. We delineated four microhabitat types (oasis, tinaja, riffle, and seep) which each supported distinct aquatic invertebrate communities. Communities were not distinct by mountain range, but rare species were occasionally found only in a single mountain range. Aquatic vertebrates were not diverse across the study area but were often locally abundant, especially big-eyed leopard frog (*Rana magnaocularis*). Two native freshwater fishes, desert chub (*Gila eremica*) and Sonoran topminnow (*Poeciliopsis occidentalis*), were found at two sites each, and exotic (introduced) tilapias were found at all four sites in the sierras Santa Ursula and Bacatete. Tilapia presence was strongly associated with a shift in aquatic invertebrate community structure and reduced invertebrate density and species richness. The condition of these diverse aquatic habitats ranged from nearly pristine to heavily impacted. Groundwater withdrawal, increasing human visitation, and introduction of exotic fishes are all significant threats to the diversity of aquatic organisms in these habitats.

2012-11-15 13:15:00 **The receding waters of Walker Lake, Nevada: a history of its fishery and status update on the Lahontan cutthroat trout, *Oncorhynchus clarki henshawi*, and tui chub, *Siphateles bicolor***

Medhurst, R. Bruce[*1], Herbst, David B.[1], Bell, Ian D.[1]. (1-Sierra Nevada Aquatic Research Lab).

Walker Lake, Nevada, is a terminal lake which is one of two remaining relics of Pleistocene Lake Lahontan (the other being Pyramid Lake, NV). Walker Lake is fed by the Walker River which has experienced several large scale climate related fluctuations in discharge over its 40,000 year history but more recently, a significant and rapid reduction due to agricultural use over the past 130 years. Native Lahontan Cutthroat Trout, *Oncorhynchus clarki henshawi*, (LCT) populations began declining around 1860, and attempts to bolster the fishery through stocking began as early as 1909 when lake salinity was at 3.2g/l total dissolved solids. By the 1950s, with reduced river inflows and a lake salinity of 6.8g/l, natural spawning in the Walker River had diminished to an extent that the fishery was entirely dependent upon planted LCT from other populations. In an attempt to create a viable fishery, over 49 species of brackish and fresh water fish species were tested in Walker Lake, none of which survived salinities in excess of 8.4g/l in 1963 except LCT and native Tui Chub, *Siphateles bicolor*. The loss of aquatic invertebrates, a critical fish food resource, has also occurred with the amphipod *Hyalella* and seed shrimp Ostracoda disappearing in the mid 1980s at a salinity near 10g/l. By 1995, at a salinity of 13g/l, LCT required acclimation to saline water before planting in Walker Lake with limited success once lake salinity exceeded 15g/l in 2005. In an effort to restore Walker Lake, Congress enacted a law in 2005 that created a program to acquire water rights from willing sellers in the Walker Basin in order to send more water on to the lake. However, with current lake salinity in excess of 19g/l, the continued survival of Tui Chub, the remaining aquatic invertebrates on which they depend, and use of the lake by migrating water fowl is in question.

2012-11-15 13:30:00 **Population dynamics of benthic invertebrates at Walker Lake (Nevada) under changing lake levels and potential food web alteration**

Bell, Ian D.[*1], Herbst, David B.[1], Medhurst, R. Bruce[1], Roberts, Scott W. [1]. (1-Sierra Nevada Aquatic Research Laboratory, University of California).

Nearly one hundred and fifty years of agricultural diversions have dropped Walker Lake, Nevada over thirty vertical meters, and drastically increased the total dissolved solids levels content in the lake. The benthic invertebrates of Walker Lake are an important part of the food web that sustains populations of native fish, so understanding invertebrate population dynamics as salinity and lake level changes is vital to understanding the food web linking nearshore benthic habitat to the pelagic fish and migratory water birds. We studied the population dynamics of the primary benthic invertebrates of Walker Lake: the damselfly *Enallagma clausum*, the Chironomid midges *Cricotopus ornatus* and *Tanypus grodhausi*, the alkali fly *Ephydra hians*, and the dytiscid beetle *Hygrotus masculinus*. Over the past five years, we regularly sampled cobble rock substrates from nearshore littoral habitat to determine benthic invertebrate densities. We also conducted lake bottom sampling using an Ekman Dredge, used stable isotopes of nitrogen and carbon to construct food webs for the lake ecosystem, and surveyed aquatic vegetation beds where many invertebrates reside. Population trends over the period of 2007 to 2010, as the lake declined 4 meters and lost 20% of its volume, showed a decline in the abundance of the nearshore midge *Cricotopus*, little change in the abundance of damselfly *Enallagma*, and an increase in the salt-tolerant alkali fly, *Ephydra hians*. After declining to a historic low lake level in 2010, the lake rose almost four feet in 2011 following a winter of >50% above average Sierra snowpack, which corresponded to an increase in peak densities and biomass of both *Enallagma* and *Cricotopus* as lake levels came up and salinities declined. Stable isotope ratios from samples collected in 2010 and 2011 show that the primary food source of the Tui chub, *Siphateles bicolor* appears to be the damselfly *Enallagma*. Damselfly nymphs in turn feed mainly on larvae of *Cricotopus*, and large nymphs appear also to feed on smaller nymphs. Lake levels have steadily declined since 2011. Walker Lake is currently at a historic low and salinities are approaching 20 g/L. As the lake level continues to change, documenting past, present and future shifts in the benthic invertebrate community will show how the food web is altered, the potential for supporting recovery of Walker Lake fish and birds, and contribute to our understanding of the limits and transitions of biological communities in desert lake ecosystems.

2012-11-15 13:45:00 **Defining salinity limits on the survival and growth of benthic insects as conservation management targets for saline Walker Lake, Nevada, USA**

Herbst, David B.[*1], Medhurst, R. Bruce[1], Roberts, Scott W.[1], Bell, Ian D.[1]. (1-Sierra Nevada Aquatic Research Laboratory).

Walker Lake, Nevada, a saline desert lake, has been undergoing loss of stream inflows, lowering of lake level, and concentration of dissolved salts for over a century due to agricultural diversions of water. This lake is or has been inhabited by native fish and visited by many species of water birds that depend on productive invertebrate life for food resources. The extent to which salinity limits the present and future viability of resident invertebrate fauna was evaluated using salt-tolerance bioassays and studies of salinity effects on growth and behavior in larval stages of the midges *Cricotopus ornatus* and *Tanypus grodhausi*, and nymphs of the damselfly *Enallagma clausum*. We found that salinities into and above a range of 20-25 g/L present either lethal limits or sublethal inhibitions to survival and growth that will eliminate or substantially reduce the current community of common benthic invertebrates. Midge mortality was high above 25 g/L and damselfly nymphs were most vulnerable in early instars, and grew slowly and fed less when salinity increased from 20 to 30 g/L. A conservation target for the lake that incorporates survival of native fish and optimum production of invertebrate life should be within the range of 10 to 15 g/L salinity of Walker Lake water.

2012-11-15 14:00:00 **Effects of a declining lake elevation and increasing TDS levels on Lahontan tui chub in Walker Lake, Nevada**

Wright, Karie A.[*1]. (1-Nevada Department of Wildlife).
Over allocation of water rights in the Walker Basin, Nevada, has resulted in a decline in Walker Lake level. This decline has caused an increase in total dissolved solids (TDS) concentrations and resulted in a depauperate freshwater fish community. Walker lake TDS are mostly comprised of bicarbonate, sodium, sulfate, and chloride, which degrade gill and kidney functions and impact survivorship and size of fishes. Toxic TDS levels have eliminated other native fishes such as LCT (*Oncorhynchus clarki henshawi*), Tahoe sucker (*Catostomus tahoensis*), Lahontan redside shiner (*Richardsonius egregious*), and Lahontan speckled dace (*Rhinichthys osculus*) that once lived in Walker Lake. Lahontan tui chub (*Siphateles bilcolor pectinifer* and *S. b. obese*) are the last remaining fish species. Stage of egg development in tui chub was observed in order to document changes in viability as TDS concentration naturally increased in Walker Lake. Advanced development in tui chub embryos declined and an increase in deterioration was observed as TDS levels rose. An assessment of the tui chub population indicated a complete absence of cohorts under age three when TDS exceeded 15 g/L and once TDS exceeded 17 g/L, no cohorts under age five were found. Based on observed symptoms of physiological stress and mortality observed latter in the study the maximum tolerance of adults is likely to be around 20 g/L. At the conclusion of the study, gill net catch per unit effort (CPUE) was less than one tenth the CPUE from five years earlier when TDS levels were under 15 g/L. Understanding the effects of increasing TDS levels on tui chub provides resource managers valuable information that will aid in decision making for future management and restoration of the fishery as well as for future water acquisitions.

2012-11-15 14:15:00 **Desert fishes research and management in Texas during 2012**

Bean, Megan[*1], Garrett, Gary[1], Edwards, Bob[2], Montagne, Mike[3]. (1-Texas Parks and Wildlife Department, 2-University of Texas - Pan American, 3-USFWS Texas Fish and Wildlife Conservation Office).
The federally threatened Devils River minnow (*Dionda diaboli*) is at risk of extirpation from one of three known locations, Pinto Creek. Upper and lower portions of the creek have gone dry due to diminished spring flow. The region continues to suffer through an intense drought and groundwater pumping has been identified as another potential threat to loss of critical habitat. The Pinto Creek population has declined within the past eight years from 10% of the total fish assemblage in 2004 to 2% in 2011. This past summer, approximately 160 Devils River minnows were captured from Pinto Creek and placed in refugia at San Marcos Aquatic Resources Center. Pecos Pupfish (*Cyprinodon pecosensis*) is at risk of extirpation from Texas. Recent surveys showed the range is now restricted to about a mile of Salt Creek, a tributary of the Pecos River. Pecos pupfish are hybridizing with Cyprinodon variegatus and loosing habitat as a result of reduced spring flow. Pecos Pupfish from Salt Creek have been placed in refugia at the Fort Worth Zoo, and Texas Parks and Wildlife Department and the U.S. Fish and Wildlife Service are currently seeking an alternate site to secure their existence in a second habitat. Rio Grande silvery minnow (*Hybognathus amarus*) recovery and monitoring efforts continue in Texas. Over two million Rio Grande silvery minnows have been released into the Big Bend region of the Rio Grande during the last five years. Monitoring efforts for the Big Bend gambusia (*Gambusia gaigei*) are also continuing. A new refuge has been established near the existing refuge and both populations appear to be thriving. In early September, Gary Garrett represented Texas Parks & Wildlife Department at a meeting of the Commission for Environmental Cooperation in Mexico City. The goals of the meeting were biological planning and development of a conservation strategy for approximately 3,000,000 acres in the Big Bend region in Texas and Mexico. The final report, entitled The Big Bend-Río Bravo Collaboration for Transboundary Landscape Conservation, is scheduled for release in January and is meant to provide a binational and comprehensive regional approach to conservation based on the best available scientific information and expert opinion.

2012-11-15 14:30:00 **Why restore and protect desert fishes? Lessons from history, economics and biology**

Bonar, Scott A.[*1]. (1-USGS Arizona Cooperative Fish and Wildlife Research Unit).
In times of limited funding and competing priorities, why preserve the strange and unique organisms that inhabit aquatic ecosystems of the desert? Significant research has been conducted to conserve these species. Yet a critical part of conserving aquatic ecosystems in the desert is being able to explain to the general public what substantial benefits they provide. Conservation professionals have made good arguments why these organisms should be protected, yet further information is available still to those who need to convince reluctant segments of the public as to their value. Fish and other species found in desert waters have played important roles in human history, serving economic, medical, religious, food and technological functions. Many were critical for advancing society. Today aquatic species in desert waterways provide millions of dollars to local economies, and are contributing to breakthroughs in human health, engineering and other disciplines. Advances in technology are unlocking further benefits to humans from these unique organisms. An overview of the value provided from aquatic ecosystems in the desert provides many reasons why they are so important to protect.

2012-11-15 14:45:00 **Combining ecological and genetic data to determine the exchangeability of populations for conservation**

Rader, Russell[*1], Belk, Mark C.[1], Shiozawa, Dennis K.[1], Crandall, Keith A.[1]. (1-Brigham Young University).
Resource managers often decide which local populations should be preserved to maintain intraspecific variation and they often determine which local populations would enhance captive-breeding programs, augment endangered local populations, and which populations could best be used to re-introduce native species into historically occupied areas. Populations are ecologically exchangeable when individuals can be moved between different local sites and still occupy the same ecological niche. Populations that are in-exchangeable are synonymous with local populations adapted to different environmental conditions. I will describe a procedure that uses the complementary strengths, while recognizing the limitations, of both molecular genetic data and ecological experiments to determine the ecological exchangeability of local populations within a species. This is the first synthesis of a combined approach (experiments and genetics). Although it would be ideal to find functional genes that interact to influence quantitative traits resulting in ecological differences (e.g. growth, size, fecundity), we suggest that our current knowledge of functional markers is too limited for most species to use them to differentiate adaptively different local populations. Thus, we argue that ecological experiments using whole organisms combined with neutral markers that indicate evolutionary divergence, provide the strongest case for detecting adaptive differences among local populations.

2012-11-15 15:00:00 **The role of behavioral ecology in management of endangered pupfishes**

Gumm, Jennifer[*1]. (1-Stephen F. Austin State University).
Management strategies based on behavioral phenotypes may be effective when inter- or intra-specific interactions lead to declines in genetic variation or size of a population. Population and community composition can influence reproductive behaviors, fitness as well as biodiversity. Here, I highlight two systems where behavioral studies influence management strategies in endangered pupfishes (genus *Cyprinodon*). Within a population, the social environment has important consequences for individual reproductive behavior and fitness. In the endangered Comanche Springs pupfish, *C. elegans*, males

express one of three alternative reproductive tactics (ARTs); territoriality, satellite behavior, or female mimicry. Field studies have established that population composition facilitates spawning by female mimics in the natural population and that aggression towards female mimics is dependent on local social environments. Using behavioral and genetic methods in a laboratory study, I directly tested the fundamental relationship between ecological, demographic variables and evolutionary processes (i.e. sexual selection) by quantifying the fitness outcomes of males expressing ARTs. Population density and sex ratio influenced aggressive behavior and reproductive success of males expressing different tactics. On the community level, interspecific dynamics can influence individual behavior and population size. In a desert spring system in West Texas, an endangered egg predator, *Gambusia nobilis* altered breeding behavior and contributed to the decline of the endangered Leon Springs pupfish, *C. bovinus*. Habitat restoration resulted in decreased egg predation pressure and a corresponding resurgence in the pupfish population. Direct conflicts between multiple endangered species present unique challenges to conservation and, this is the first example of effective management of deleterious interactions between two endangered species using habitat restoration to alter behavioral patterns.

2012-11-15 15:15:00 **Ecological replication and evolutionary trajectories: managing for evolutionary past, present & future**

Stockwell, Craig[*1], Collyer, Michael[2], Heilveil, Jeffrey[3]. (1-North Dakota State University, 2-Western Kentucky University, 3-SUNY College at Oneonta).

One of the challenges for conservation biologists is to conserve both *evolutionary legacy* and *evolutionary potential* while allowing populations to *evolve in contemporary time*. Here, we consider the evolutionary ecology of the White Sands pupfish *Cyprinodon tularosa* to illustrate the challenges of meeting these three goals. Substantial genetic divergence for many neutral markers, as well as evidence for adaptive divergence in body shape, provides the basis for managing these populations as the Malpais Spring and Salt Creek *Evolutionarily Significant Units* (ESUs). To further secure the *evolutionary legacy* of *C. tularosa*, one conservation action is to establish and maintain refuge populations for each ESU. One such "refuge" population of the Salt Creek ESU was historically established in Mound Spring, an ecologically dissimilar habitat. A microsatellite survey revealed no measurable evidence of genetic drift in the Mound Spring population, but this population has undergone adaptive divergence toward a deep body shape. One approach of providing *evolutionary potential* is to maintain high levels of genetic variation for the refuge populations by establishing managed gene flow from the ancestral population. Even low levels of managed gene flow, however, can impede local adaptation, so it is prudent to weigh the costs and benefits of gene flow. In the case of Mound Spring, the benefits of gene flow are marginal, but the cost could be substantial if gene flow compromises local adaptation. Thus, the best action may be to treat the Mound Spring population as a separate *Management Unit* of the White Sand pupfish. More broadly, refuge populations established in ecologically dissimilar habitats have the potential to undergo similar *contemporary evolutionary divergence* and in the broadest sense, they represent potential incipient species. One could argue that such adaptive diversification may provide unique opportunities for conserving biodiversity during the Anthropocene.

2012-11-15 15:30:00 **Revisiting the "nature of nurture": how insights from developmental ecology can inform desert fish conservation**

Lema, Sean C.[*1]. (1-Biological Sciences Department, California Polytechnic State University, San Luis Obispo).

Aquatic habitats in the desert have distinctive environmental characteristics relative to their counterparts in wetter climates. Whether a large desert river or a small, isolated spring or marsh, the physical conditions of these aquatic habitats have shaped the evolutionary adaptations and genetic variation of the fishes that live there. Conservation efforts for desert fishes have accordingly focused on preserving a species' unique phenotypic adaptations and the genetic variation underlying those adaptations, and, in many cases, have also sought to maintain the distinguishing environmental conditions of the aquatic habitat. In scenarios where conservation efforts have relied on artificial refuges or aimed to restore degraded habitats to support self-sustaining populations, it is clear that the likelihood of phenotypic shifts in these built environments can be high. Such phenotypic changes have often been attributed to shifts in genetic composition (e.g., founder effects, genetic drift), but it is also necessary to consider the developmental influences that built environments can have on phenotypic expression. Over the past decade, accumulating evidence has revealed that heritable change in ecologically relevant phenotypic traits can occur even with little genetic variation. These changes may arise through environmentally induced developmental plasticity or through mechanisms that have been traditionally categorized as 'non-genetic,' such as epigenetic variation, behavioral inheritance, and maternal effects. Here, I will explore how recent insights into the 'nature of nurture' provide a fuller understanding of how organism-environment interaction shapes phenotypic variation. I will draw on specific findings of neural, behavioral and morphological plasticity in desert pupfishes and salmonids to illustrate how investigations that borrow approaches from developmental ecology and ecological genetics can uncover overlooked mechanisms of interaction that developmentally link the phenotypic characteristics of fish to their habitats. Such mechanisms provide a window into the interconnectedness of fish and their environments, and inform our understanding of the origins of phenotypic variation in wild populations. Moreover, they can complement genetic approaches to improve conservation efforts aimed at managing the phenotypic responses of desert fishes in built environments including artificial refuges, hatcheries, and restored habitats.

2012-11-15 15:45:00 **Springsnail ecology and captive propagation**

Rogowski, David L.[*1]. (1-Department of Natural Resources Management, Texas Tech University).

Springsnails are often endemic to a single spring and the management and conservation of the springsnails has been typically limited to protecting habitats. Spring systems are primarily threatened from habitat loss (e.g. declining water flows resulting from groundwater extraction) and invasive species. Catastrophic events such as a fire, pollution, or even the introduction of an invasive species can extirpate or exterminate a species. In view of these potential threats and vulnerability of springsnails, propagation and the maintenance of captive populations would significantly increase the security of these vulnerable species. For the majority of springsnails little to nothing is known of their ecology or life history. Successful propagation and maintenance of captive populations of springsnails has been difficult. Simply placing a species in a lighted, filtered, and temperature regulated aquarium is rarely sufficient to ensure success. Replicating spring systems in the laboratory is a challenge and laboratory preferences of springsnails do not always follow field observations. Some species prefer warmer temperatures than are present in the field, and show no preference in depth contrary to field observations. Here I present an overview of our experiences in trying to maintain viable captive populations of a variety springsnails.

Entra texto de resumen en espaï¿½ol

2012-11-15 16:00:00 **"Wild at Heart": maintaining genetic diversity in an endangered species using alternative breeding and rearing strategies**

Osborne, Megan[*1], Turner, Thomas[1]. (1-University of New Mexico).
"Wild at heart": The endangered Rio Grande silvery minnow persists as a remnant population in a highly fragmented and regulated arid-land river system. The species is subject to dramatic fluctuations in density hence, captive breeding, rearing and refugial populations have become central elements for conservation of this species. The captive propagation and augmentation plan for silvery minnow seeks to maintain a strong connection between the wild and captive/refugial populations. For example, eggs are collected from natural spawning events and reared in protective custody and then released to the wild at a less vulnerable life stage. These fish are also used as a broodstock. Unlike 'zoo-based' breeding programs, which may select individuals for mating based on measures such as those that reduce average relatedness (as a way to maximize genetic diversity), the breeding program for Rio Grande silvery minnow incorporates group spawning with randomly selected individuals. In this study, genetic outcomes in addition to measures of productivity (number of eggs and viability) were compared between three mating designs currently in use for this species. Measures of genetic diversity did not differ significantly across mating designs nor did the number of eggs produced. The percentage of viable eggs was significantly greater in the environmentally-induced communal spawn compared to the alternative strategies. We also present results of 15 years of genetic monitoring for the species which shows that augmentation of the wild population with captive reared and/or bred individuals has buffered the population against catastrophic losses of genetic diversity that are predicted to coincide with periods of extremely low population density.

2012-11-15 16:15:00 **Reproductive success of individual razorback suckers in impounded backwaters**

Saltzgiver, Melody[*1], Marsh, Paul[1], Turner, Tom[2], Dowling, Tom[1]. (1-Arizona State University, 2-University of New Mexico).
The endangered Razorback Sucker is indigenous to the Colorado River system. This once widespread species has become rare, with the largest aggregation currently found in Lake Mohave. This species has been heavily impacted by predation from a suite of non-native fishes, with no natural recruitment in Lake Mohave. The Native Fish Work Group has developed a conservation protocol where wild razorback sucker larvae are collected from the lake, and reared in protective custody until they are large enough reduce the incidence of predation. Off-channel ponds and impounded backwaters are critical for this plan, serving as mesocosms that would provide valuable refuges for conservation of this species. Given this strategy, it is important to obtain essential information for informed management of this species in such habitats. We explored the reproductive success of razorback sucker in ephemeral backwaters of Lake Mohave. Fin clips were taken from all adults stocked into study sites and genetic profiles were generated using 14 microsatellite markers. During spawning and in the subsequent autumn, samples of offspring were gathered from each site, and genetic profile generated for each. Profiles of offspring were compared to adults in order to identify parents of individual larvae or juveniles. There was considerable variability in levels of productivity among sites, but given the right conditions, many adults can contribute to larval production using backwater habitats, allowing for maintenance of high levels of variation found within this species.

2012-11-15 16:30:00 **Recruitment ecology and conservation of pelagic-broadcast spawning minnows**

Hoagstrom, Chris[*1], Turner, Tom[2]. (1-Department of Zoology, Weber State University, 2-Museum of Southwestern Biology).
Pelagic-broadcast spawning is a dominant mode of fish reproduction in the sea, but not in freshwater where suitable habitats appear to be limited. Notably, Fundamental Triad and Loophole processes that support pelagic-broadcast spawning in oceans and estuaries have analogs in rivers of the plains where pelagic-broadcast spawning minnows were historically widespread and diverse. Ecological evidence suggests these minnows are adapted to exploit a common sequence of events initiated by peak flows that invigorate nutrient flux and meso-habitat formation in unconfined, braided riverscapes. During flow recession, temporary, meso-scale nurseries are relatively abundant and patchily distributed. Drifting embryos that passively colonize these nurseries likely experience lower competition and predation risk, providing an explanation for synchronous spawning during peak-flow events, poor recruitment during base-flow periods, and population extirpation where peak flows or natural river-channel morphology are degraded. Similar to many pelagic-broadcast spawning marine fishes, pelagic-broadcast spawning minnows throughout North America occupy relatively unproductive habitats that are geographically extensive and structurally homogenous. Interestingly, pelagic-broadcast spawning minnows of the plains differ from those elsewhere. Whereas plains endemics are sensitive to impoundment, flow regulation, and river-channel degradation, pelagic-broadcast spawning minnows from the North American lowlands have benefitted from these changes, expanding their range on the plains. This contrast is consistent with patterns in the ocean that demonstrate the adaptive potential of pelagic-broadcast spawning. Further, it shows the importance of linking species life-histories and reproductive ecology with critical ecological processes to understand and conserve fish biodiversity.

2012-11-15 16:45:00 **Assessing the effectiveness of facilitated migration using genetic monitoring**

Martin, Andrew[*1]. (1-University of Colorado Boulder, Ecology and Evolutionary Biology).
Across the globe, wild populations of a large number of species are becoming increasingly fragmented and isolated as a consequence of human activities. Population fragmentation and isolation can intensify probabilities of extirpation and species extinction from demographic, ecological, genetic and stochastic effects. There is increasing interest in using facilitated migration as a means of mitigating the detrimental effects fragmentation and isolation of natural populations. Here I report on a study in which a small number of individuals of *C. n.pectoralis* were moved from North Indian to South Scruggs to investigate the effects of facilitated migration. Individuals were monitored every 4 months using genetic techniques. Mark recapture estimated provide the basis for estimating survivorship for three groups: migrants, residents, and admixed individuals. Intriguingly, the rank order of survivorship, from highest to lowest, was admixed, migrants, residents. The study demonstrates that it is possible to successfully monitor the fate of individuals and genome types in populations, a strategy that may become increasingly important as populations may be subject to increasing manipulation.

2012-11-15 17:00:00 **The Ash Meadows Fish Conservation Facility**

Weissenfluh, Darrick S.[1]. (1-U.S. Fish and Wildlife Service).
Low fish counts at Devils Hole and a concomitant lack of back up populations, due in part to inadequate facilities, prompted the U.S. Fish and Wildlife Service and partners to secure Southern Nevada Public Land Management Act funds to build a state of the art facility. The new facility is in the final commissioning stages and has been named the Ash Meadows Fish Conservation Facility (AMFCF). The AMFCF is located within the Ash Meadows National Wildlife Refuge, Amargosa Valley, NV, and it is vision is to serve two purposes: (1) support research and management actions which aid in the

conservation of imperiled aquatic species and (2) establish and sustain a refugial population of endangered Devils Hole pupfish, *Cyprinodon diabolis*, as well as support research related to the Devils Hole ecosystem. The AMFCF consists of a support building complete with office space, a propagation/lab room, and a mechanical room, the latter of which is connected to a recirculation system for a 100,000 gallon concrete tank. The concrete tank, which is semi-cavernous and consists of an upper and lower shelf similar to Devils Hole, was designed to serve as a Devils Hole pupfish refuge. Commissioning of the refuge tank has demonstrated water temperature can be maintained at the same water temperature as Devils Hole and current construction modifications are intended to also maintain dissolved oxygen levels and pH similar to those occurring in Devils Hole, if desirable. The construction of the AMFCF will further recovery actions for the Devils Hole pupfish and presents a unique opportunity to create new - and strengthen existing - partnerships that can utilize the AMFCF to carry out collaborative research on imperiled aquatic species of the desert southwest.

2012-11-15 17:15:00 **Where do we go from here? Session discussion and wrap-up**

Stockwell, Craig[*1], Osborne, Megan[2]. (1-North Dakota State University, 2-Department of Biology and Museum of Southwestern Biology, University of New Mexico).

2012-11-15 17:30:00 **The Coahuilan connection to the interior highlands**

Hoagstrom, Chris[*1]. (1-Department of Zoology, Weber State University).

Ancient highlands of southeastern North America are hot spots of fish diversity and the Ouachita Orogen is the main tectonic feature linking them. Some fish clades are distributed along this feature, yet, no study has assessed biogeographical trends for the entire length of the orogen. A preliminary assessment shows the Ouachita Orogen is closely paralleled by a generalized track of North American highland fishes. Several aspects of this formation explain its evolutionary significance: (1) during formation, it conformed to & integrated with more ancient highland areas that also were geologically stable, (2) subsequently, it served as an abrupt boundary (ecotone) between coastal & continental environments with suitable habitat for upland fishes, (3) ancient fragmentation via dissolution & erosion isolated highland areas, but (4) dispersal corridors among areas were periodically re-configured. Landscape stability sustained ancient lineages, ecological diversity encouraged vicariant speciation, & dynamic dispersal corridor evolution allowed emerging lineages to periodically expand & diversify.

2012-11-15 17:30:00 **Fish in your backyard? Factors affecting trout presence in Wasatch Front creeks**

Anderson, Tyler[1], Vanderpool, Madison[1], Hoagstrom, Chris[1]. (1-Department of Zoology, Weber State University).

Many small creeks flow into communities between Bountiful and Brigham City along the Wasatch Front in Northern Utah, originating in canyons that have very similar topography, but which have been isolated from one another due to community growth. Some of these creeks contain trout. The isolation of many very similar creeks allows for a very unique investigation of the factors that influence trout populations. An understanding of what factors contribute to a creek's ability to support successful trout populations will enable future management of creek habitats for recreational fishing and for re-introduction of Bonneville Cutthroat Trout. We investigated the presence or absence of trout in these creeks to determine what factors are associated with trout presence. Backpack electrofishing was conducted near the mouth of each creek's parent canyon, above most manmade structures. In general, creeks with trout were deeper, larger, and less steep. However, these features alone did not guarantee the presence of trout. Some creeks, such as Mill Creek in Bountiful and Willard Creek near Willard, contained no trout despite being relatively deep, wide, and having shallow slope and long drainage circumference. Large floods in recent decades may have affected once existing trout populations in these creeks.

2012-11-15 17:30:00 **A nonlethal aging technique for threatened, endangered, and sensitive fishes**

Albrecht, Brandon[*1], Rogers, Ron[1], Kegerries, Ron[1], Shattuck, Zach[1], Holden, Paul[1]. (1-Bio/WEST).

Typical morphological structures used for aging fish include scales, otoliths, spines, opercular bones, vertebrae, branchiostegal bones, and fin rays. Many of these structures are either unreliable for aging many native sucker species, or their use requires the fish to be sacrificed. Pectoral fin rays offer a nonlethal and reliable alternative to aging native, sensitive, or listed fish species. Since 1999, BIO-WEST, Inc., has developed, refined, utilized, and benefited from employing a nonlethal aging technique to understand the recruitment patterns of a wild, self-sustaining population of razorback sucker (*Xyrauchen texanus*) in Lake Mead, Arizona and Nevada. To date, we have successfully aged 360 wild, naturally produced razorback suckers from Lake Mead. BIO-WEST, Inc., has expanded the use of this technique to successfully age nearly 320 razorback suckers and 145 flannelmouth suckers (*Catostomus latipinnis*) captured from the Lower Colorado River. More recently, we have successfully aged 28 native suckers from Lake Powell, Utah. This aging technique has demonstrated that reliable, nonlethal aging of rare and long-lived fishes is feasible. Furthermore, this technique has applicability to provide valuable ecological and management insight into a variety of fishes, even those considered to be threatened, endangered, or otherwise imperiled.

Entra texto de resumen en espaï¿½ol

2012-11-15 17:30:00 **Fish fauna of the natural protected areas: Monumento Natural Cerro de la Silla y Sierra de la Silla, Nuevo León, México**

Lozano Vilano, Ma. de Lourdes[*1], García Ramírez, Ma. Elena[1], Contreras Balderas, Armando Jesus[1], García Salas, Juan Antonio[1], García Contreras, Elsa Victoria[1]. (1-Universidad Autónoma de Nuevo Leon, Lab. Ictiología).

The two Natural Protected Areas, the Monumento Natural and Sierra de la Silla, are part of the physiographic province of the Sierra Madre Oriental. Not know previous studies in the area, in this work, we report 21 species of fishes, with 4,253 specimens in 18 genera and 9 families, according to zoogeographic origin 10 species are Nearctic, 10 Neotropical and one Ethiopian, according to ecological affinity 11 are primary, 8 secondary and 2 peripheral. 7 species are non-native, spread over 2 exotic by invasion (threadfin shad, *Dorosoma petenense* and inland silverside *Menidia beryllina*, 4 by translocation: (western mosquitofish,*Gambusia affinis*; spottail killifish, *Heterandria bimaculata*; porthole liverbearer, *Poeciliopsis gracilis* and green swordtail, *Xiphophorus hellerii*), and one by introduction (blue tilapia, *Oreochromis aureus*). Among the 21 species, 6 are in some category within the

Norma Oficial Mexicana (NOM-059-SEMARNAT-2010), 5 as Threatened (red shiner, *Cyprinella lutrensis*; Mexican red shiner, *C. rutila*; Texas shiner, *Notropis amabilis*; Rio Grande shiner, *N. jemezanus*, Rio Grande darter , *Etheostoma graham*), and one as Endangered (spotted minnow, *Dionda melanops*). Inside of the Red List, IUCN (2011) appears as status Vulnerable *Etheostoma graham*.

El Monumento Natural Cerro de la Silla Y Sierra de la Silla, N.L. México, forma parte de la Provincia Fisiográfica de la Sierra Madre Oriental. No existen trabajos previos en el área, en este trabajo se reportan un total de 21 especies con 4,253 ejemplares de peces repartidos en 18 géneros y 9 familias; de acuerdo al origen zoogeográfico 10 especies son Neárticas, 10 Neotropicales y una etiópica; de acuerdo a su afinidad ecológica 11 son primarias, 8 secundarias y 2 periféricas. 7 especies son no nativas, repartidas en 2 exóticas por invasión (Dorosoma petenense, machete amarillo y Menidia beryllina, charal de marea, 4 por translocación: (Gambusia affinis, guayacón común; Heterandria bimaculata, guapote manchado; Poeciliopsis gracilis, guagpote Jarocho; Xiphophorus helerii, cola de espada) y uno por introducción (Oreochomis aureus, tilapia). De las 21 especies, 6 se encuentran con alguna categoría dentro en la Norma Oficial Mexicana (NOM-059-SEMARNAT-2010), 5 como Amenazadas (Cyrinella lutrensis, sardinita rojiazul; C. rutila, sardinirta regiomontana; Notropis amabilis, sardinita ojona; N. jemezanus, sardinita pálida y Etheostoma grahami, dardo del Bravo), y 1 En Peligro (Dionda melanops, sardinita rayada). Dentro de la Lista Roja de la IUCN (International Union for Conservation of Nature and Natural Resources) (2011) aparece con estatus de Vulnerable a Etheostoma grahami.

2012-11-15 17:30:00 **Fishes of the Parque Nacional Cumbres Monterrey, Nuevo León, México**

Lozano Vilano, Ma. de Lourdes[*1], Garcia Ramírez, Ma. Elena[1], Espinosa Narváez, Mayra Alejandra[1]. (1-Universidad Autónoma de Nuevo León, Lab. Ictiología).

El Parque Nacional Cumbres Monterrey (PNCM), created on November 24, 1939 by decree of Lázaro Cárdenas, was established for the conservation of flora and fauna. It has two major rivers that cross it, the Santa Catarina and San Juan. Here are reported 28 fish species in 11 families and 21 genera. According to its zoogeographical origin, 14 species are Nearctic, 15 Neotropical, one Palearctic and one Ethiopic. Within the Ecological Affinity, 16 are primary, 12 Secondary and three Peripheral. There are 9 non native species, spread over three alien invasion (gizzard shad, *Dorosoma cepedianum*; threadfin shad, *Dorosoma petenense* and inland silverside *Menidia beryllina*), four are exotic by translocation, (western mosquitofish,*Gambusia affinis*; spottail killifish, *Heterandria bimaculata* ; porthole liverbearer, *Poeciliopsis gracilis*; green swordtail, *Xiphophorus hellerii*) and two by introduction (common carp, *Cyprinus carpio* and blue tilapia, *Oreochromis aureus*). Among the 19 native species, eight are within a risk in the NOM-059-SEMARNAT-(2010), six are as Endangered (red shiner, *Cyprinella lutrensis*; Mexican red shiner, *Cyprinella rutila*; Texas shiner, *Notropis amabilis*; Rio Grande shiner, *Notropis jemezanus*; gray redhorse, *Scartomyzon congestus*; Rio Grande darter, *Etheostoma grahami* and spotted minnow, *Dionda melanops*), and as Special Protection (headwater catfish, *Ictalurus lupus*). The IUCN Red List (International Union for Conservation of Nature and Natural Resources) (2011) as Vulnerable *Etheostoma graham*.

El Parque Nacional Cumbres Monterrey (PNCM) fue creado el 24 de noviembre de 1939 por decreto de Lázaro Cárdenas, fue constituido para la conservación de flora y fauna. Cuenta con dos importantes ríos que la atraviesan, Santa Catarina y San Juan. Aquí se reportan 28 especies de peces repartidas en 11 familias y 21 géneros. De acuerdo a su origen Zoogeográfico, 14 especies son Neárticas, 12 Neotropicales, una Paleártica y una Etiópica. Dentro de la Afinidad Ecológica 16 especies son Primarias, 9 Secundarias y tres Periféricas. Existen 9 especies no nativas, repartidas en 3 exóticas por invasión (Dorosoma cepedianum, sardina molleja; Dorosoma petenense, machete amarillo y Menidia beryllina, charal de marea); cuatro son exóticas por translocación (Gambusia affinis, guayacón común; Heterandria bimaculata, guapote manchado; Poeciliopsis gracilis, guatopote jarocho; Xiphophorus hellerii, cola de espada) y dos por introducción (Cyprinus carpio, carpa común y Oreochromis aureus, tilapia). Dentro de las 19 especies nativas, ocho se encuentran dentro de algún tipo de riesgo en la NOM-059- SEMARNAT-(2010), 6 como Amenazadas (Cyprinella lutrensis, sardinita rojiazul; Cyprinella rutila, sardinita regiomontana, Notropis amabilis, sardinita ojona, Notropis jemezanus, sardinita pálida, Scartomyzon congestus, matalote gris y Etheostoma grahami, dardo del Bravo); una En Peligro (Dionda melanops, sardinita rayada) y una como Protección Especial (Ictalurus lupus, bagre lobo). En la Lista Roja de la IUCN (International Union for Conservation of Nature and Natural Resources) (2011) como Vulnerable (Etheostoma grahami).

2012-11-15 17:30:00 **Freshwater fishes from the upper Río Nazas, Durango, México**

Herrera Barquin, Hiram[1], Lozano Vilano, Ma. de Lourdes[1], García Ramírez, Ma. Elena[1]. (1-Universidad Autónoma de Nuevo León, Lab. Ictiología).

The state of Durango occupies the northern end of the interior of Mexico. Nazas-Aguanaval region represents one of the most important water resources in the nation. This study was conducted in the upper basin of the Rio Nazas, formed by the tributaries of the rivers Sextin, Ramos, Tepehuanes and Santiago. The objectives are to make an inventory of fish species found there, as well as develop zoogeographical and ecological analysis. A collection trip was made in January 2009 that lasted 20 days and with a total of nine locations visited. Collection methods usually consisted of 3 m long and 1.5 m wide net, 1 / 16 "mesh, spoon nets and electrofishing equipment. In total, the material obtained was of 12 species distributed in 7 families and 12 genera. Based on their natural distribution, species found were 9 natives, 2 aliens and 1 undescribed (*Catostomus spp.*); About their zoogeographical origin, 8 are Nearctic and 2 Neotropical; According to their ecological affinity, 11 are primary and 1 secondary; within the Norma Oficial Mexicana (NOM-059-SEMARNAT-2010), five are threatened (carpita adornada,*Codoma ornata*; Carpita jorobada, *Cyprinella garmani*; carpa Mayrán, *Gila conspersa*; bagre lobo, *Ictalurus pricei* ; Nazas pupfish, *Cyprinodon nazas*) and 5 without definite legal status. The basin faces serious problems of exploitation of natural resources along its banks, with deforestation for agriculture and livestock areas, excessive logging for the exploitation of timber resources, river pollution by domestic wastes and chemicals, introduction of exotic species of fishes and inappropriate use of water.

El estado de Durango ocupa el extremo norte del interior de México. La cuenca Nazas –Aguanaval representa uno de los recursos hídricos más importantes de la nación. Este estudio se llevo a cabo en la cuenca alta del Río Nazas, formada por los afluentes del rio Sextin, Ramos, Tepehuanes y Santiago. El objetivo fue hacer un inventario de los peces que se encuentren allí; así como desarrollar un análisis zoogeográfico y ecológico. Se hizo un viaje de recolección en el mes de enero del 2009 con una duración de 20 días se visitaron un total de 9 localidades. La colecta se realizo con chinchorro de 3 m de largo y 1.5 m ancho, con una luz de malla de 1/16 redes de cuchara y equipo de electropesca. El material obtenido fue de 12 especies distribuidas en 7 familias y 12 géneros. Sobre la base de su distribución natural las especies encontradas fueron 9 nativos 2 exóticos y 1 especie indescrita (Catostomus sp). Por su origen zoogeográfico 8 son Neárticas y 2 Neotropicales. De acuerdo a su afinidad ecológica, 11 son primarias y 1 secundaria. Dentro de la Norma Oficial Mexicana (NOM-059-SEMARNAT-2010) 5 son amenazadas (Codoma ornanta, carpita adornada; Cyprinella garmani, carpita jorobada, Gila conspersa carpa Mayran, Ictalurus pricei bagre lobo; Cyprinodon nazas, Nazas cachorrito) y 5 sin estatus legal definido. La cuenca se enfrenta a problemas graves de explotación de los recursos naturales a lo largo del río, con la deforestación para zonas agrícolas y ganaderas, la tala excesiva para la explotación de los recursos madereros, la contaminación del rio por desechos domésticos y los productos químicos, la introducción de especies exóticas y el uso

inadecuada del agua

2012-11-15 17:30:00 **Collection of larval and early juvenile humpback chub, *Gila cypha*, from the Little Colorado River in Grand Canyon for use in translocation experiments**

Morton-Starner, Rylan[*1], Ward, David[1]. (1-USGS, Grand Canyon Monitoring and Research Center).

Large numbers of juvenile humpback chub, *Gila cypha*, are needed for translocation experiments into tributaries of the Colorado River in Grand Canyon. These translocation efforts are limited by the number of fish large enough to be PIT tagged,

2012-11-15 17:30:00 **What environmental factors reduce predation vulnerability for native fishes?**

Knecht, Tammy[*1], Ward, David[2]. (1-US Fish and Wildlife Service, Parker AZ, 2-USGS, Grand Canyon Monitoring and Research Center).

The incompatibility of native Colorado River fishes and nonnative warm water fishes is well documented with predation by nonnative species causing rapid extirpation of native species in most locations. In a few rare instances native fishes are able to survive and recruit despite the presence of nonnative warm water fishes, indicating that specific environmental conditions may help reduce predation vulnerability. We experimented with turbidity, artificial water colorant, woody debris, aquatic vegetation, or rock substrates in a laboratory setting to determine if any of these types of cover could reduce predation vulnerability and confer survival advantages for juvenile bonytail chub, *Gila elegans*. Bonytail chub were exposed to predation by adult largemouth bass, *Micropterus salmoides*, or green sunfish, *Lepomis cyanellus*, in overnight trials. Turbidity above 1,000 NTU reduced predation vulnerability by up to 50 percent, with no other treatment significantly reducing predation mortality. If our results can be extended to other species, they may help to explain patterns of wild juvenile razorback sucker, *Xyrauchen texanus*, recruitment at the turbid inflow of the Colorado River into Lake Mead.

2012-11-15 17:30:00 **Ecology of North American Freshwater Fishes- A forthcoming textbook from the University of California Press**

Ross, Stephen T.[*1]. (1-University of New Mexico, Museum of Southwestern Biology).

The North American freshwater fish fauna is the most diverse temperate fish fauna in the world as well as one of the best-studied faunas. Ecology of North American Freshwater Fishes integrates ecological and evolutionary principles and concepts with the processes involved in the formation and maintenance of this fauna. The intended audience for this book includes upper-level undergraduate students, graduate students, professional fish biologists, and anyone else curious about or with a passion for fishes. The book should be appropriate for use in one or two semester, undergraduate and/or graduate courses in fish ecology. Part 1 provides a broad picture, both spatially and temporally, of the derivation of the fauna, including examples of how global and North American geological and climatological processes have shaped the fauna. Part 2 focuses on how local populations and assemblages are formed and how they persist, or not, through time. Part 3 deals with the relationship of body form and life history patterns as they are related to ecological functions. The numerous interactions among individuals and species through communication, competition, predation, mutualism, and facilitation are the topics of Part 4. Part 5 focuses on several primary conservation issues such as flow alterations and the increasing biotic homogenization of faunas. The five parts lead the reader from a broad-scale appreciation of why specific species and assemblages occur in particular places, to how individuals and species interact with each other and with their environments, how such interactions have been altered by anthropogenic impacts, and the relative success of efforts to restore damaged ecosystems.

2012-11-15 17:30:00 **Mitochondrial genome structure of the Yaqui catfish (*Ictalurus pricei*) in Northwest México**

Ballesteros-Córdova, Carlos A.[*1], Camarena-Rosales, Faustino[2], Grijalva-Chon, Manuel[1], Castillo-Gámez, Reyna A.[1], Varela-Romero, Alejandro[1]. (1-Universidad de Sonora, 2-Universidad Autónoma de Baja California).

The study of catfishes is very important due of its diversity. The order siluriform has more than 2,400 species. In Mexico there are three native families including Ictaluridae, the only one group of freshwater catfishes of North and Central America. Mexico has been considered as the center of speciation of the genera *Ictalurus*. Besides this, the catfishes present a high commercial value in aquaculture, which generates interest for its study and conservation. The Yaqui Catfish (*Ictalurus pricei*) is a potential aquaculture species, endangered due to the cultivation of exotic catfish in their natural habitats, promoting reduction in their distribution and abundance. The data obtained at date show that their study and conservation should be based on comprehensive analysis of their phylogenetic relationships involving morphological features, biogeographic evidence and sequencing of its genome. Once known and deciphered the genomic composition is possible to understand the evolutionary forces that originated their different species. Obtaining the sequence and structure of the mitochondrial genome of the Yaqui catfish, it will reveal their specific and geographical identity, setting backgrounds of knowledge to propose strategies for its conservation. To comply with this objective we sampled the Yaqui, Mayo and Fuerte rivers, collecting Yaqui catfish specimens from which DNA was extracted. At the moment, we have achieved fragments of the genes 16SrRNA, COXI, COXIII, ND1, ND2, ND4, ND5, and under edition the sequences obtained of tRNAGlu, tRNAThr, tRNAPro, tRNAPhe, tRNAVal, 12SrRNA, CYTB and D-LOOP. A total of 10,241 bp were sequenced, which corresponds to approximately 61.5% of the entire genome. The oligonucleotides will be designed from sequences of obtained genes from this study to complete the whole genome sequence. The obtained sequences will be compared with in sequence and structure with other species to determinate its genetic variation and a genetic map will be constructed to show differences. The Phylogenetic trees will be constructed using PAUP 4.0b10 by maximum parsimony, maximum likelihood and Bayesian inference criteria to evaluate phylogenetic inference of the complete mitochondrial genome of the native catfish in Northwestern Mexico.

El estudio de bagres es de gran importancia debido a que es un grupo muy diverso, el orden siluriforme posee más de 2,400 especies. En México existen tres familias nativas de bagres, incluyendo Ictaluridae, único grupo de bagres dulceacuícolas pertenecientes a Norteamérica y América Central. México ha sido mencionado como el centro de especiación del género *Ictalurus*. Además, los bagres presentan un alto potencial acuícola, lo que genera interés para su estudio y conservación. El bagre Yaqui (*Ictalurus pricei*) es una especie de importancia acuícola, amenazada por el cultivo de bagres exóticos en sus hábitats naturales, ocasionando reducción en su distribución y abundancia. Los datos obtenidos hasta el momento evidencian que su estudio y conservación deben sustentarse en análisis integrales de sus relaciones filogenéticas involucrando rasgos morfológicos, evidencia biogeográfica y secuenciación de su genoma. Una vez conocida y descifrada la composición genómica es posible entender las fuerzas evolutivas que originaron su diversidad de especies. Se

espera que al obtener la secuencia y estructura del genoma mitocondrial del bagre Yaqui, se revele su identidad específica y geográfica, sentando bases para proponer estrategias de conocimiento para su conservación. Para cumplir con este objetivo se muestrearon los Ríos Yaqui, Mayo y Fuerte recolectando especímenes de bagre Yaqui de los que se extrajo ADN. Hasta el momento se han logrado obtener fragmentos de los genes 16SrRNA, COXI, COXIII, ND1, ND2, ND4, ND5 y están en proceso de edición las secuencias obtenidas de los tRNAGlu, tRNAThr, tRNAPro, tRNAPhe, tRNAVal, 12SrRNA, CYTB y D-LOOP. Se cuenta con 10,241 pb lo que corresponde aproximadamente al 61.5% del genoma completo. Se diseñarán oligonucleótidos a partir de las secuencias de los genes obtenidos durante el presente estudio para la secuenciación del genoma completo. Con las secuencias obtenidas se realizarán comparaciones con las secuencias y estructura de otras especies de bagres para determinar su variación genética y se construirá un mapa genético para observar estas diferencias. Se construirán árboles filogenéticos utilizando PAUP 4.0b10 con los criterios de distancias genéticas, máxima parsimonia, máxima probabilidad e inferencia Bayesiana para evaluar la inferencia filogenética del genoma mitocondrial completo en la filogenia de los bagres nativos del Noroeste de México.

2012-11-15 17:30:00 **Mitochondrial genome structure of the Sinaloa catfish *Ictalurus* sp. in Northwest México**

Catañeda-Rivera, Melissa[1], Ruiz-Campos, Gorgonio[2], Gutierrez-Millan, Luis E.[1], Grijalva-Chon, Manuel[1], Varela-Romero, Alejandro[1]. (1-Universidad de Sonora, 2-Universidad Autónoma de Baja California).

Ictaluridae, the only one group of freshwater catfishes of North and Central America. Mexico has been considered as the center of speciation of the genera *Ictalurus*. Inside this species we can found Sinaloa catfish inhabiting the San Lorenzo and Sinaloa Rivers basins in the states of Sinaloa and Durango, in the pacific slopes in the Sierra Madre Occidental. It is recognized as a new species within the complex of native catfish of Northern Mexico based on their morphology and evidence of CYTB and Control region genes. Molecular characterizations of the native catfish mitochondrial genome as the Sinaloa catfish as well as their phylogenetic relationships are necessary to propose strategies for understanding and management of his biodiversity. Mitochondrial genes as the CYTB gene have been used for phylogenetic inference catfish studies for phylogenetic relationships. In recent years have been popular use complete sequences of the mitochondrial genome. Obtaining the sequence and structure of the mitochondrial genome of the Sinaloa catfish, it will reveal their specific and geographical identity and infer their evolutionary origin. To comply with this objective we sampled the San Lorenzo and Sinaloa rivers, from which DNA was extracted. At his moment, we have generated fragments of different sizes that correspond to genes 16SrRNA, COXI, COXII, COXIII, ND1, ND2, ND4, and ND5, along with the complete sequence of the tRNAGlu, CYTB, tRNAThr, tRNAPro, Control Region, tRNAPhe, tRNAVal and 12SrRNA. A total of 11,105 bp were sequenced, which corresponds to approximately 65% of the entire of genome. The oligonucleotides will be designed from gene sequences of obtained genes from this study to complete whole genome sequence. The obtained sequences will be compared with in sequence and structure with other species to determinate its genetic variation and a genetic map will be constructed to show differences. The Phylogenetic trees will be constructed using PAUP 4.0b10 by maximum parsimony, maximum likelihood and Bayesian inference criteria to evaluate phylogenetic inference of the complete mitochondrial genome of native catfish in Northwestern Mexico.

Ictaluridae, único grupo de bagres dulceacuícolas pertenecientes a Norteamérica y América central. México ha sido mencionado como el centro de especiación del género *Ictalurus*. Dentro de sus especies se encuentra el bagre de Sinaloa que habita las cuencas de los Ríos Sinaloa y San Lorenzo en los estados de Sinaloa y Durango, en la vertiente Pacífico de la Sierra Madre Occidental. Es reconocido como una nueva especie al interior del complejo de bagres nativos del Norte de México con base en su morfología y evidencia de los genes CYTB y Región Control. La caracterización molecular del genoma mitocondrial de bagres nativos como el de Sinaloa y sus relaciones filogenéticas, son necesarias para proponer estrategias de conocimiento y manejo de la biodiversidad. Los genes mitocondriales como el gen CYTB han sido utilizados para las inferencias filogenéticas de los bagres, pero en los últimos años ha resultado muy popular la utilización de secuencias de genomas mitocondriales completos. Se espera que al obtener la secuencia y estructura del genoma mitocondrial del bagre de Sinaloa, se revela su identidad específica y geográfica, para inferir su origen evolutivo. Para cumplir con este objetico se muestrearon los Ríos Sinaloa y San Lorenzo recolectando especímenes de bagre de Sinaloa de donde se extrajo el ADN. Hasta el momento se han generado fragmentos de diferentes tamaños que corresponden a los genes 16SrRNA, COXI, COXII COXIII, ND1, ND2 ND4 y ND5, junto con las secuencias completas de los tRNAGlu, Cytb, tRNAThr, tRNAPro, Región Control, tRNAPhe, 12SrRNA y tRNAVal. Se cuenta con 11,105 pb lo que corresponde aproximadamente al 65% del genoma completo. Se diseñarán oligonucleótidos a partir de las secuencias de los genes obtenidos durante el presente estudio para completar la secuenciación del genoma. Con las secuencias obtenidas se realizarán comparaciones con las secuencias y estructura de otras especies de bagres para determinar su variación genética y se construirá un mapa genético para observar estas diferencias. Se construirán árboles filogenéticos utilizando PAUP 4.0b10 con los criterios de distancias genéticas, máxima parsimonia, máxima probabilidad e inferencia Bayesiana para evaluar la inferencia filogenética del genoma mitocondrial completo en la filogenia de los bagres nativos del Noroeste de México.

2012-11-15 17:30:00 **The role of intraguild predation on potential impacts of invasive mosquitofish, *Gambusia affinis*, on Ash Meadows pupfish, *Cyprinodon nevadensis* ssp.**

Skinner, Samantha M[*1], Holte, Brady A[1], Henkanaththegedara, Sujan M[1], Stockwell, Craig A[1]. (1-Department of Biological Sciences, North Dakota State University).

Our previous work (Henkanaththegedara & Stockwell, 2012, Ecol. Freshwater Fish, DOI: 10.1111/j.1600-0633.2012.00587.x) showed that intraguild predation is a potential mechanism for the co-existence of native fish species with non-native western mosquitofish, *Gambusia affinis*. Mosquitofish have invaded many springs in Ash Meadows National Wildlife Refuge, a “hot spot” for endemic species, posing a potential threat to endemic fish. However, pupfish, *Cyprinodon nevadensis ssp.*, native to Ash Meadows co-exist with non-native mosquitofish in many springs. We conducted laboratory predation trials to investigate the role of intraguild predation between non-native mosquitofish and pupfish using a surrogate species, Sheepshead minnow, *Cyprinodon variegatus*. Both male and female mosquitofish predators significantly reduced larval sheepshead minnow prey survival compared to the control (3.3% and 6.7% survival, respectively; $\div^2 = 61.26$; d.f. = 2; $p < 0.0001$). By contrast, sheepshead minnows had limited predation on mosquitofish larvae. Male sheepshead minnows did not prey on larval mosquitofish prey. However, female sheepshead minnow predators significantly reduced larval mosquitofish prey survival to 86.7%($\div^2 = 8.43$; d.f. = 2; $p < 0.05$). Our results suggest that mosquitofish predation may be a critical factor for the survival of pupfish in invaded habitats such as Ash Meadows.

2012-11-15 17:30:00 **Phototaxis of larval bonytail**

Massure, Wade[*1], Ehlo, Chase[1], Kesner, Brian[1], Marsh, Paul[1]. (1-Marsh & Associates).

Bonytail *Gila elegans* is a federally listed endemic fish species of the Colorado River basin. Recruitment in nature is precluded by non-native fish predation on early life stages. Although light traps have been successfully used to capture bonytail larvae, phototaxis has never been experimentally tested. Six larval fish traps were constructed of 5 cm ABS crosses, trap adapters, caps, LED lights, and 500 ìm Nitex cones. Lighted and dark traps were tested

simultaneously and separately in aquaria in 2 and 4 h trials. Mean proportions of larval captures in lighted only trials were 62 and 68% of available larvae for 2 and 4 h trials, respectively, and lighted traps tested simultaneously with dark traps captured mean proportions of 49 and 73% of available larvae for 2 and 4 h trials, respectively. Combined for all trials, dark traps captured a total of one larva. Results from our study support phototaxis in bonytail at swim-up stage.

2012-11-15 17:30:00 **Population ecology of the mottled sculpin, *Cottus bairdii*, in a desert creek system**

Ambos, Aaron[*1]. (1-Southern Nevada Water Authority).

Cottus bairdii is a widespread sculpin species that occurs across much of the U.S. and into southern Canada. Although absent from most of the desert southwest, its distribution does include creek systems within the Great Basin Desert in eastern Nevada and western Utah. 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. This creek system maintains a native fish fauna comprised of redside shiner (*Richardsonius balteatus*), speckled dace (*Rhinichthys osculus*), Utah chub (*Gila atraria*), Utah sucker (*Catostomus ardens*), and mottled sculpin (*C. bairdii*). As part of a biological monitoring program in 2009-2011, an annual three-pass depletion survey was conducted along four to six 100-meter reaches, spaced along the entire system. Each 100 m reach was isolated from the system using block-nets, and three passes were made with a Smith-Root LR-24 Electrofisher. *C. bairdii* was only detected on the same single reach at a location of spring inflows [suggest adding this, as it appears to be relevant to the species and is interesting] during each annual sampling effort. In 2009, 89 *C. bairdii* were recorded with a catch rate of 3.5 fish/minute. An apparent increasing population trend was shown in 2010 and 2011 with a recorded 295 individuals (catch rate of 16.1 fish/minute) and 766 individuals (catch rate of 17.8 fish/ minute) respectively. By 2011, although *C. bairdii* had the most limited distribution in the system, it was the most abundant fish species in the reach of occurrence. Fish length frequency was similar in 2009-2011 and mean length for the three years was 50.4mm, 52.5mm, and 52.1mm respectively. Fall 2012 sampling will focus on *C. bairdii* distribution upstream and downstream of the reach of known occurrence to identify all occupied areas within the system, and will continue the collection of trend data.

2012-11-15 17:30:00 **The *Cyprinodon julimes* experiment: a case study for development of a broadly effective conservation model in Mexico**

De la Maza-Benignos, Mauricio[1], Carson, Evan W.[2], Lozano-Vilano, Lourdes[3], Vela-Vallardes, Lilia[1], Banda-Villanueva, Iris[1]. (1-Pronatura Noreste, A. C., 2-Department of Biology, University of New Mexico, 3-Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León).

The effects of longstanding and growing demands on water resources in the desert regions of Mexico have raised a question of whether novel approaches to species and habitat conservation should be considered. One newly implemented experiment is based on a recent initiative for conserving the Julimes pupfish, *Cyprinodon julimes*. In this test case conservation efforts have focused on integrating biological and hydrological elements crucial to survival of this microendemic species with local landowner needs and participation. Primary attention was been directed toward achieving sustainable water use, as measured by stability and continued viability of water levels and the biotic community within Julimes Spring. This effort has thus far led to marked improvements in use of water resources, as well as stabilization of Julimes Spring and reduced threats to the persistence of *C. julimes*. These promising results suggest that actively guiding local communities towards sustainable management of water resources, combined with long-term habitat and population monitoring, may present the only effective means of conserving aquatic species in many areas in Mexico, especially in places where traditional conservation actions are impractical or unfeasible. The following are among the critical lessons learned during this experiment: i) effective outreach at the local community level is needed to correct prevailing misconceptions of what constitutes efficient water-use. For example, one major problem is the widespread view that flowing water is water wasted; ii) implementation of sustainability programs developed by State governments is imperative. Such plans, for example, have been developed and are being initiated in Chihuahua; and iii) water-rights policies must be reconfigured to favor sustainable resource use and preservation of ecosystem function. Although this promising paradigm for water management is recognized under the Mexican National Water Law of 1992, successful implementations have largely been sporadic and local due to a continued failure to bring federal policy to operational fruition. Local-regional initiatives will remain crucial for success.

2012-11-15 17:30:00 **My, what big eyes you have. All the better to see you with? A comparison of eye diameter and maximum gape between native and non-native fishes from the southwestern United States**

Moran, Clinton J.[*1], Knecht, Tammy[2], Gibb, Alice C.[1]. (1-Northern Arizona University, 2-U.S.F.W.S.).

Eye size in predators ranging from mammals to fishes has been associated with visual capabilities. Lager eyes allow more photons to enter the eye per solid angle of image. Many southwest cyprinids have evolved in turbid environments, so turbid that vision perhaps played a reduced role in their sensory systems than what is required in today's less turbid environments. Thus we observe small beady eyes in most of the cyprinids across the southwest. We photographed several members of the southwestern Cyprinidae as well as many introduced piscivores. Using imaging programs we digitized eye diameter, maximum gape, and standard length. With these measurements we compared both within the natives and between natives and non-natives. Within the native Cyprinids there was comparatively little variability in eye size relative to standard length. However, when non-native piscivores were introduced to the comparison it was clear that native Cyprinids have significantly smaller eyes than non-native predators. When comparing native cyprinids to non-natives maximum gape was also typically much larger in non-native piscivores. Consistently, the largest maximum gape per unit of standard length was seen in the Centrarchidae. These results have significant implications for the current and future state of southwestern Cyprinids. Having smaller eyes relative to a competitor or predator has drastic survival and competitive disadvantages. Predation on the Cyprinidae, at all life history stages, and higher competitor fitness play a significant role in the decline of the southwest Cyprinidae.

2012-11-15 17:30:00 **Newly created riparian ponds during stream restoration: diel oxygen fluctuations**

Rackliffe, D. Riley[*1], Fairbanks, Douglas[1], Rader, Russell[1]. (1-Brigham Young University).

Riparian wetlands have only recently been included in stream restoration efforts even though they increase overall biodiversity and may play a critical role in determining rates of ecosystem function. In Hobble Creek, a tributary to Utah Lake, riparian ponds may also create potential rearing habitat for the endangered June sucker (*Chasmistes liorus*). However, summer-time fish kills have been observed in some ponds presumably attributed to low dissolved

oxygen levels. We collected data on dissolved oxygen, vegetation percent cover, and pond physical characteristics. Our data suggests that water depth (< 30 cm deep), shading, and the abundance of algae may determine the duration of nighttime low oxygen levels in the summer. Atmospheric oxygen enters aquatic systems across the air-water interface, or as a byproduct of photosynthesis. In shallow ponds dissolved oxygen concentrations are largely determined by rates of photosynthesis versus rates of respiration. Algae rich shallow ponds (periphyton, filamentous greens, Chara) reached levels as high as 500% DO by day and as low as 20% at night. Algae allow oxygen produced during photosynthesis to "leak" from the cell wall causing dissolved oxygen levels to increase during daylight hours whereas, rooted macrophytes do not "leak" oxygen to the surrounding water but may decrease rates of photosynthesis because of shading. At night when photosynthesis has halted cellular respiration and decomposition consume oxygen. However, deeper ponds may be more resistant to the nightly lows increasing the likelihood of fish survival. These observations will be used to design an experiment showing the effects of algal abundance, shading and water depth on oxygen concentrations in shallow waters.

2012-11-15 17:30:00 **Improving stocking success with predator recognition training**

O'Neill, Matthew W.[*1], Stewart, William[1]. (1-Arizona Game and Fish Dept.).

Predation by non-native fish may be the main source of mortality for bonytail and razorback suckers in the lower Colorado River. Hatchery-raised native fish are stocked naïve to this risk and therefore may not survive their first encounter with a predator. We are developing a protocol to train large groups of hatchery-raised, native fish to recognize predators in an effort to improve post-stocking survival. We use the cypriniform alarm pheromone, known to be present in the skin of many cypriniform species, to train groups of hatchery-bred, predator-naïve fish to recognize largemouth bass as dangerous. The alarm pheromone is collected by sacrificing and skinning a hatchery fish; the skin is blended with water to form a solution containing the alarm substance. Groups of hatchery fish are trained to recognize a predator by placing a bass into their tank and simultaneously adding the alarm pheromone. The bass is removed from the training tank after five minutes, and the hatchery fish are moved into a fresh tank. To document training success, 20 trained and 20 untrained fish (all previously pit-tagged so individuals can be identified) are placed into a concrete pond with four bass for 24 hours, and we compare percent survival of each group. Often a group of bonytail individuals, upon being introduced to the bare pond, immediately hide under the bass for cover. A second group of fish tends to school and keep their distance from the predators, but because we cannot determine which individuals are performing which behavior it is unknown if it is the trained animals that are avoiding the bass. Initial survival results, though not statistically significant, suggest that training will reduce predation compared to untrained fish. If predator avoidance training continues to show promise, further experiments will include introducing habitat, larger field tests, and scaling training to a hatchery production pond size.

2012-11-15 17:30:00 **The evolution and maintenance of deeply divergent lineages of red shiner, *Cyprinella lutrensis*, in the Rio Grande watershed**

Diver, Tracy A.[1], Turner, Thomas F.[1], Osborne, Megan J.[1]. (1-Department of Biology and Museum of Southwestern Biology, University of New Mexico).

Cyprinella lutrensis, Red Shiner, is widely distributed throughout North America. The species is a widespread complex of variable forms in the United States and Mexico. Early studies of mitochondrial DNA variation showed significant phylogeographic structuring of the species across its range. We studied mitochondrial ND4 sequences of individuals collected from the Pecos River and Rio Grande in New Mexico revealing two deeply divergent lineages (consistent with genus-level differences) that co-occurred in both rivers. To evaluate the origin and maintenance of this variation we 1) compared mtDNA with nuclear markers to evaluate whether mtDNA lineages were reproductively isolated and 2) quantified levels of genetic diversity within each lineage to understand the probable colonization history of the basin. Haplotypes between the two rivers are not shared, suggesting complete isolation, and levels of genetic diversity are surprisingly low within each lineage, with measures of mtDNA diversity comparable to endangered species. Low levels of genetic diversity suggest the Red Shiner has historically experienced population bottlenecks. Morphological analysis and DNA sequences from the nuclear RAG-1 gene are not correlated to mtDNA haplotypes, suggesting no reproductive isolation between lineages. We conclude that the Upper Rio Grande Basin was colonized twice by divergent lineages of Red Shiner, with the first event much older than the second. Subsequently, the Rio Grande and Pecos Rivers were isolated more recently, leading to divergence of each lineage across the basin.

2012-11-15 17:30:00 **Tributary use and movement in the San Juan River fish community**

Cathcart, C. Nathan [1], Gido, Keith B.[1], McKinstry, Mark[2]. (1-Kansas State University, 2-Bureau of Reclamation).

Fishes often require diverse habitats throughout their lives, and those habitats are often distributed throughout a stream network. Accordingly, fulfillment of different life stages will involve movement among those habitats. Using a riverscape study design, we identified abundance and dispersal of fishes across broad spatial scales, with a focus on tributary confluences. Within riverscapes, confluence zones often serve as areas of more frequent exchange between habitats that differ in their abilities to fulfill specific life history attributes of species. To identify movement patterns and quantify tributary use of the San Juan River fishes, we tagged all fishes >115 mm with passive integrated transponder (PIT) tags in tributary stream and mainstem San Juan River sites in 2012. Fish detections relied on three stationary PIT antenna arrays in the McElmo Creek system complimented by four mobile PIT antennas used at strategic locations of McElmo Creek, Yellow Jacket Creek, Chaco Wash, and the San Juan River. We found tributary confluences were used frequently by endangered species, and their movements into these habitats coincided with increasing discharge, and potential seasonal patterns of habitat use. These results suggest tributary habitats are potentially important for multiple life stages of endangered species but also may provide refugia for nonnative channel catfish, *Ictalurus punctatus*. Future objectives will be to identify ecological correlates to movement patterns of fishes.

2012-11-15 17:30:00 **Newly created riparian ponds during stream restoration: resilience of macroinvertebrates, zooplankton, and vegetation to flooding**

Fairbanks, Douglas[*1], Rader, Russell[1], Rackliffe, D. Riley[1]. (1-Brigham Young University, Department of Biology).

For years, riparian wetlands have been largely neglected when studying stream ecosystems. They have only recently been included in stream restoration efforts even though they increase overall biodiversity and may play a critical role in determining rates of ecosystem function. Despite our best efforts to research a particular subject, nature can easily change our plans without warning. Restored riparian wetlands around the edges of Utah Lake experience constant fluctuation as wet or dry years contribute to rising and falling water levels. In 2011, high water flooded the wetland ponds and eliminated the zooplankton population. One year after the flooding, zooplankton populations have rebounded and recolonized the ponds. Further statistical analysis of the data that has been collected is necessary to draw precise conclusions, however, three years of observations imply that the riparian wetland is highly resilient to flood events as macroinvertebrates, zooplankton, and vegetation have all rebounded within a year of the disturbance. However, resetting the community composition does allow invasive plants like Phragmites australis an opportunity to edge out less vigorous native species. Invertebrates are heavily impacted by mosquito fish (*Gambusia affinis*). Wetlands should be carefully watched after disturbances to prevent dominance of invasive species.

2012-11-16 08:30:00 **Spawning ecology of the critically endangered Moapa dace, *Moapa coriacea*, revealed through underwater videography**

Ruggirello, Jack E.[*1], Bonar, Scott A.[1], Feuerbacher, Olin G.[1]. (1-University of Arizona, School of Natural Resources and the Environment, AZ Cooperative Fish and Wildlife Research Unit).

Moapa dace, *Moapa coriacea*, are a critically endangered cyprinid endemic to the Warm Springs area of Clark County, Nevada. Because of its limited range, low abundance, and impacts from introduced species, Moapa dace were federally listed as an endangered species within thirty years of being described. The spawning ecology, a portion of Moapa dace life history that is crucial to comprehend for its recovery, is not fully understood. We installed twelve underwater cameras, one every ten meters, in the uppermost reach of Plummer Stream. Cameras were equipped with infrared light to record both day and night activity. Camera sites were randomly selected to represent a variety of habitat-types (i.e. pools, glides, runs, and riffles). We quantified available habitat by dividing the field of view in front of each camera into a grid to measure size and embeddedness of substrate, depth, stream velocity, and categorize cover. We recorded approximately 21,000 hours of video from March through May 2012. We randomly selected sixteen 10-minute video clips in every 24-hour period, from each camera, to analyze for spawning activity. Based on activity reviewed to date, Moapa dace appear to be broadcast spawners. Spawning events were recorded in three sites; one in a run, four in a glide, and five in a pool. Three spawning events occurred between 7:50am to 9:00am and seven between 2:10pm and 6:40pm. Further knowledge of the spawning ecology of Moapa dace will be important for identifying factors that induce spawning in captivity and will provide crucial data for managers to utilize in habitat improvement projects.

2012-11-16 08:45:00 **Oregon - Northern California Area Report**

Scheerer, Paul[*1], Reid, Stewart[2], Markle, Douglas[3], Hoekzema, Kendra[3], Meeuwig, Michael[1], Banks, David, Hurn, Shannon[1], DeHaan, Patrick[4]. (1-Oregon Department of Fish and Wildlife, 2-Western Fishes, 3-Oregon State University Department of Fisheries and Wildlife, 4-US Fish and Wildlife Sevice Conservation and Genetics Laboratory).

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) estimated Warner sucker, *Catostomus warnerensis*, abundance and tracked seasonal movements in the Warner Lakes, 2) obtained a population estimate for Borax Lake chub, *Gila boraxobius*, in the Alvord subbasin, 3) obtained a population estimate and evaluated habitat conditions for Foskett Spring speckled dace, *Rhinichthys osculus* ssp., in Foskett and Dace Springs, 4) completed a 6 yr study assessing the distribution and obtaining population estimates for Interior redband trout, *Oncorhynchus mykiss*, in six subbasins in SE Oregon, 5) treated Sage and Line Canyon Creeks (McDermitt drainage) with rotenone to remove rainbow trout and hybrids from Lahontan cutthroat, and 6) toured the aftermath of lightning fire on Lahontan cutthroat habitat in the McDermitt subbasin (Corral, Sage, Line Creeks) and Willow-Whitehorse subbasin (Little Whitehorse, Cottonwood, Fifteen, Doolittle, and Whitehorse Creeks). Pat DeHaan, U.S. Fish and Wildlife Service, in collaboration with ODFW, completed a genetic analysis of Warner suckers in four Warner basin tributaries and found that none of the tributary populations showed reduced levels of genetic variation, that each tributary contains a genetically independent spawning population, and found levels of genetic variation in a refuge population were similar to those in the natural populations. 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 (OSU) assessed the effects of parasites on juvenile recruitment in Klamath suckers. Kendra Hoekzema (OSU), in collaboration with BLM and ODFW, conducted 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 included a systematic assessment of the taxonomic status of the threatened Foskett speckled dace, revealed patterns of genetic connectivity across the landscape, and tested for the presence of cryptic species or subspecies. Dave Banks and Anna Kerr (ODFW) worked with landowners in the Honey Creek subbasin to initiate fish passage and screening projects for Warner suckers, and conducted surveys for Pit sculpins in the Goose Lake subbasin. The Marci Schreder, Lake County Watershed Council, and Troy Brandt, River Design Group, completed several watershed enhancement projects in the Goose Lake and Chewaucan subbasins focusing on fish passage and stream bank stabilization for native fishes.

2012-11-16 09:00:00 **Can members of the *Gila* complex be identified as morphologically distinct across life history stages?**

Moran, Clinton J.[*1], Lerma, Carlos[1], Jimenez, Yordano[1], Gibb, Alice C.[1]. (1-Northern Arizona University).

Cyprinids in the genus *Gila* from the southwestern United States are difficult to identify by species because members of the genus, especially at juvenile and young adult life history stages, have very similar body designs. Species identification within the genus is further complicated by hybridization between coexisting species and putative morphological differences within a species between drainages. This study sought to quantify the differences between species in the genus as well as possible differences within a species between waterways using standard meristic traits and measurements of body proportions taken from digital images of preserved specimens and live specimens collected in the field. Because fishes at later life history stages are more distinct from one another we focused on characteristics that can distinguish species at juvenile and young adult stages. We note that morphological differences are minimal in juvenile fish, but changes in proportion arise as fish grow larger. Some morphological characteristics varied between water ways and among *Gila* species including: caudal peduncle depth, caudal peduncle length and dorsal fin base length. Although morphological differences did exist within a species, it is not clear if this variability is genetic, or the result of developmental plasticity. These results could have further implications in reexamining the species distinctions within the genus *Gila* as well as assisting with field identifications. Further investigation will be conducted on various species in the *Gila* complex to determine the functional significance of morphological variation within a species.

2012-11-16 09:15:00 **Can streams containing Apache Trout be cooled? Relationships between environmental variables and stream temperature with management implications under climate change**

Price, Joy[*1], Bonar, Scott[1]. (1-University of Arizona, Arizona Cooperative Fish and Wildlife Research Unit).

The distribution of Apache trout, *Oncorhynchus gilae apache*, a threatened species endemic to eastern Arizona, and that of other Southwestern coldwater species, may be compressed due to increased stream temperatures, potentially further exasperated by global climate change. Knowledge of environmental conditions which best buffer stream temperatures against temperature increase and fluctuation may help preserve current Apache trout distribution. We

measured relationships of various environmental variables to water temperature in four Arizona streams, and modeled how management activities could be used to cool streams to temperatures below the upper thermal tolerance of Apache trout. Changes in stream discharge; density and species of riparian vegetation; and channel width were evaluated. Altering stream discharge had the greatest effect on stream temperature. Increasing stream discharge an average of.0728 cms cooled streams 1 C. Narrowing the stream channel had a greater cooling effect on wider streams with a higher level of discharge. The percent decrease in channel width required to lower streams 1 C ranged from 14% to 52% depending on the level of discharge. Increasing riparian vegetation density also kept stream temperatures from reaching critical levels; an average increase in total shade of 7% resulted in a 1 C decrease in maximum stream temperature. Ponderosa pine, *Pinus ponderosa*, provided the greatest level of shade, followed in decreasing order by, Douglas fir, *Pseudotsuga menziesii*, engelmann spruce, *Picea engelmannii*, bebb willow, *Salix bebbiana*, Arizona alder, *Alnus oblongifolia*, and coyote willow, *Salix exigua*. Many complex and variable parameters affect stream temperature, but biologists may cost effectively alter these parameters to lower the stream temperatures of many systems below critical thresholds for Apache trout or other coldwater species.

2012-11-16 09:30:00 **Using video to investigate relationships between environmental conditions and spawning behavior in Devils Hole pupfish**

Chaudoin, Ambre L. [*1], Feuerbacher, Olin G. [1], Bonar, Scott A.[1], Barrett, Paul J. [2]. (1-University of Arizona, School of Natural Resources and the Environment; USGS Arizona Cooperative Fish and Wildlife Research Unit, 2-US Fish and Wildlife Service).

The endangered Devils Hole pupfish, *Cyprinodon diabolis*, lives in a single warm spring of unknown depth within Death Valley National Park, California/Nevada. Over the past several years, *C. diabolis* has reached record-low numbers, spurring renewed conservation and recovery efforts. Though factors that influence spawning may be important in regulating *C. diabolis* population size, much is still unknown about the reproductive ecology of this notoriously difficult-to-breed species. Over 11 months, February-December 2010, we monitored spawning behavior of *C. diabolis* and associated environmental conditions within Devils Hole. A solar-powered video surveillance system, incorporating above-water and underwater cameras, provided continuous monitoring of the shallow spawning shelf. Datalogging meters continuously recorded dissolved oxygen, temperature, and lux, and monthly in-person surveys recorded time-lapse algal cover. Disturbance events (i.e. flash-floods and earthquake activity) were identified through hydrograph data. We used multiple regression to model effects of these parameters on *C. diabolis* spawning activity. Initial results suggest date, diel change in dissolved oxygen, and percent algal cover significantly predicted spawning activity ($P = 0.008$, $P < 0.0001$, $P < 0.0001$, respectively). This study additionally provides a comparison between current remote-monitoring methods and traditional survey methods for monitoring fish behavior. Results from this study inform design of *C. diabolis* captive breeding programs, and demonstrate how video technologies might be more broadly applied within the aquatic sciences.

2012-11-16 09:45:00 **Life-history variation of *Gambusia nobilis*, Pecos Gambusia, at Bitter Lake National Wildlife Refuge**

Hopkins, Alyssa[*1]. (1-University of New Mexico).

Life history characteristics are shaped by differential investment of limited resources that maximizes lifetime fitness under variable selective pressures. The live bearing Pecos Gambusia, *Gambusia nobilis*, is an ideal organism for studying ecological effects on life history because reproductive investment is made throughout embryonic development and they occupy isolated habitats with varying ecological conditions. The goal of this research is to describe seasonal and population variation in life history and ecological effects on these characteristics. Specimens for dissection were collected monthly (May 2011 through April 2012) from four populations at Bitter Lake National Wildlife Refuge, Roswell NM, (sinkholes 7, 27 South, 31, and 37). Females were gravid between April and August with brood sizes ranging from 2-49 with a mean of 16. Maternal brood reproductive effort (brood mass/eviscerated mass) increased from April to May and declined from June to July. *G. nobilis* did not strongly exhibit the brood size/average egg mass trade-off commonly observed in fishes. Brood size only accounted for 3.41% of the variation in egg size (R^2=0.0340, p=0.0569). Brood Size showed an inverse U distribution from April through August while average egg mass increased throughout the reproductive season. Increasing offspring size may maximize survival under changing environmental conditions and shortened growth period prior to overwintering. No strong correlations were found between these life history characteristics and ecological conditions except for a weak positive correlation between relative abundance of the predator Plains killifish, *Fundulus zebrinus*, and maternal brood reproductive effort (R^2=0.0416, p=0.0349). Egg mass and brood size appear most correlated to seasonal variables including water temperature, day length, and pH. Between populations, no significant difference was found in maternal brood reproductive effort, egg mass, or brood size when pooled across months. Preliminary results may also suggest unique reproductive strategies of matrotrophy and superfetation. Egg mass was significantly greater in eyed vs un-eyed embryos (possibly through matrotrophic provisioning) and females with embryos of different developmental stages were observed, supporting the hypothesis of superfetation.

2012-11-16 10:00:00 **Comparative population genetics of Gila River fishes: Life history influences on genetic diversity and gene flow**

Pilger, Tyler J.[1], Turner, Thomas F.[1]. (1-University of New Mexico, Museum of Southwestern Biology and Department of Biology).

The upper Gila River Basin in southwestern New Mexico is one of the last unimpounded drainage basins in North America, and is a stronghold for a unique and largely endemic fish fauna. However, coincident with introduction of nonnative predators, such as Smallmouth Bass, *Micropterus dolomieu*, and Yellow Bullhead, *Ameiurus natalis*, distributions of native fishes have declined. Reaches with high predator densities could inhibit natural source-sink dynamics of native fishes by disrupting migration and reducing gene flow, thereby isolating local populations and decreasing overall genetic diversity. We used microsatellite DNA markers to examine population structure of seven native species with varying life history strategies and different distributions in the system. Species with opportunistic life history strategies include Spikedace, *Meda fulgida*, Loach Minnow, *Tiaroga cobitis*, Speckled Dace, *Rhinichthys osculus* (species with patchy or limited distributions), and Longfin Dace, *Agosia chrysogaster* (widespread throughout the basin). Species with periodic life history strategies are Headwater Chub, *Gila nigra* (limited distribution), Desert Sucker, *Catostomus clarkii*, and Sonora Sucker, *Catostomus insignis* (widespread throughout the basin). We collected fin clips from 16 locations representing mainstem and tributaries; however, not all species occurred at each site. Genetic diversity of opportunistic species increased longitudinally upstream to downstream and tests of genetic divergence indicated significant population substructure within the basin. Longfin dace showed the least amount of longitudinal genetic divergence, but more patchily-distributed opportunists exhibited higher divergence values. A canyon-bound reach with high densities of predators was identified to be a substantial barrier to gene flow of opportunistic species. Analyses of periodic species indicated higher genetic diversity at upstream sites than those downstream but no appreciable population substructure. Our comparative genetic study shows that migration and persistence of patchily-distributed opportunistic species will be most strongly affected by anthropogenic and natural factors that limit habitat connectivity in the Gila River.

2012-11-16 10:15:00 **A comparison of habitat suitability criteria for Apache trout and the non-native virile crayfish**

Petre, Sally[*1], Bonar, Scott[1]. (1-University of Arizona).

Over the past century, fishes endemic to the southwestern United States have declined in abundance and range, resulting in the listing of the majority of these species (70%) under the U.S. Endangered Species Act (ESA). Apache trout, *Oncorhynchus giliae apache*, a salmonid endemic to the White Mountains of east-central Arizona, is listed as threatened under the ESA. Major reasons for the decline and listed status of Apache trout include overfishing, drought, habitat degradation and negative species interactions. A recently introduced invasive species thought to affect Apache trout recovery is *Orconectes virilis*, or virile crayfish. To date, no mechanical or chemical removal methods have been found to be effective or efficient for suppressing crayfish populations. However, altering certain habitat parameters to disfavor crayfish, while maintaining Apache trout habitat parameters, may be effective. Therefore we developed habitat suitability criteria for Apache trout and virile crayfish to assess overlap in criteria and to identify if habitat could be manipulated to favor Apache trout but suppress virile crayfish. We sampled the West Fork of the Black River by snorkel survey to identify where Apache trout were located (occupied vs. unoccupied) and measured environmental parameters (water velocity, depth, substrate, instream cover, overhead cover and temperature) at occupied and unoccupied locations. We used a $1m^2$ quadrat sampler to sample for crayfish at random locations throughout the same stream. We performed a habitat suitability analysis to develop habitat suitability criteria for both species. Apache trout and virile crayfish occupy similar depths; however, virile crayfish occupy areas with significantly lower mean water column velocity than Apache trout ($p=0.03$). Overall, virile crayfish are found in slower, warmer water compared to Apache trout and in areas where they can hide under cobbles or instream cover. We hope to use this assessment of habitat suitability criteria as a tool to better understand virile crayfish and Apache trout interactions as well as manage Apache trout recovery streams.

2012-11-16 10:30:00 **Invasive crayfish in a desert spring system: Using landscape genetics to inform ecological restoration**

Paulson, Elizabeth L.[*1], Martin, Andrew P.[1]. (1-University of Colorado - Boulder).

The delimitation of dispersal routes utilized by invasive species has the potential to direct management efforts in invaded systems, and may be used to prevent the invasion of native communities. Landscape genetics provides a powerful tool to determine post-invasion movement corridors by integrating inferences of gene flow between populations with landscape connectivity metrics. This technique was used to describe dispersal patterns of invasive red swamp crayfish (*Procambarus clarkii*) through Ash Meadows, a spring system and endemic hotspot in the Mojave Desert. A combination of anthropogenic habitat degradation and the establishment of invasive species like *P. clarkii* has caused the extinction of an endemic poolfish, and extirpations and severe population declines of endangered pupfish in Ash Meadows. Although many Ash Meadows springs are hydrologically isolated, intermittent connectivity occurs during heavy precipitation events – allowing for dispersal of native and invasive species. We used a landscape genetics approach in combination with Geographic Information System (GIS) mapping of drainages to test alternative hypotheses of *P. clarkii* invasion routes and colonization events throughout Ash Meadows. Mitochondrial DNA (COI) and microsatellite markers were used to infer colonization events and gene flow for 15 sampled populations. Modeled historic outflows, in conjunction with waterway mapping based on aerial imagery and LiDAR data, reveal highly variable drainage routes across the flat topography of Ash Meadows. These GIS maps and models explain how flooding events have caused the outflows of normally isolated springs to connect to a variety of other outflows, providing multiple corridors for movement of aquatic species between springs. Estimates of gene flow between *P. clarkii* populations (FST and assignment tests) highlight the drainages utilized by crayfish to reach distal springs. Additionally, analyses of mtDNA haplotype diversity and distribution suggest both single and multiple colonization events in isolated springs. These results will inform ecological restoration in Ash Meadows by directing the placement of barriers to prevent reinvasion of distal springs after eradication of *P. clarkii* populations.

2012-11-16 10:45:00 **Genetic variation in the San Bernardino springsnail (*Pyrgulopsis bernardina*) in the upper San Bernardino River basin in Northeast Sonora, México**

Bonillas-Monge, Mario E.[*1], Grijalva-Chon, Manuel[1], Myers, Terry[2], Castillo-Gámez, Reyna A.[1], Varela-Romero, Alejandro[1]. (1-Universidad de Sonora, 2-167 E 7th Street Eagar, Arizona 85925).

The springsnails of the *Pyrgulopsis* genus are one of the most diverse groups of freshwater mollusks in North America. Many of their species are in danger of extintion. Factors contributing to their vulnerability, but also its exceptional diversity, include poor dispersal ability and the highly specific habitat requirement. Some of these requirements are the availability, depth, temperature, and the chemical quality of the water, conditions that leading to endemism. The San Bernardino Springsnail (*Pyrgulopsis bernardina*) inhabits the upper San Bernardino River Basin and actually is restricted to a single spring in Arizona, while in Sonora, new several distribution localities have been reported. The species have been studied in the United States, and until no long time ago it was recorded only for the San Bernardino National Wildlife Refuge (SBNWR). Little is known about populations inhabiting Mexican territory. In this study, we sampled three localities, El Chorro, Agua Fria y Ojo Caliente, where (*P. bernardina*) occurs in the upper San Bernardino River Basin in Sonora, to know the presence of genetic structure. We collect 30 specimens per locality, from which 90 sequences of the mitochondrial DNA Citochrome Oxidase I gen were obtained for the analysis of genetic variability. 21 haplotypes were detected and only one of these was shared by two of the localities. In the analysis of molecular variance (AMOVA) we obtained a high genetic differentiation index (*Fst* =0.37968), and a low number of migrants per generation (*Nem* =0.8), data that means that a high grade of genetic structure was observed, suggesting that one different population occurs in each sampled arroyo into the basin. Therefore, we conclude that populations inhabiting the upper San Bernardino River Basin in Sonora, has unique genetic information and belongs to important specie's genetic pool, hence, immediate management plans implementation is critical for appropriate conservation.

Los caracoles de manantial del genero *Pyrgulopsis* son unos de los grupos más diversos de moluscos dulceacuícolas en Norte América y del cual muchas de sus especies se encuentran en peligro de desaparecer. Entre los factores que contribuyen a su vulnerabilidad y a la vez promueven su gran diversidad, destaca su pobre capacidad de dispersión activa y la alta especificidad de las condiciones de habitad. Algunos de estos requerimientos son la disponibilidad de agua y su profundidad, temperatura y calidad química, condiciones que en ocasiones provocan endemismo. El caracol de manantial de San Bernardino (*Pyrgulopsis bernardina*) habita en la cuenca del Río San Bernardino y actualmente se encuentra restringido a un sólo un ojo de agua en Arizona, mientras que en Sonora se han registrado nuevas localidades para su distribución. La especie ha sido estudiada en Estados unidos y hasta hace poco tiempo aún se presumía que sólo habitaba en el San Bernardino National wildlife Refuge (SBNWR). Poco se conoce aún sobre las poblaciones que habitan en territorio Mexicano. En este estudio, se muestrearon tres localidades, El Chorro, Agua Fría y Ojo Caliente, donde habita *Pyrgulopsis bernardina* dentro de la cuenca alta del Río San Bernardino en Sonora con el propósito de evaluar la existencia de estructura genética. Se colectaron 30 ejemplares de cada localidad en total, de los cuales obtuvimos 90 secuencias del gen mitocondrial Citocromo Oxidasa I para el análisis de variabilidad genética. Se detectaron 21 haplotipos

de los cuales sólo uno se compartió entre dos de las localidades. En el análisis de varianza molecular (AMOVA) obtuvimos un alto índice de diferenciación genética poblacional (*Fst* = 0.37968) y un bajo número de migrantes por generación (*Nem* = 0.8), lo cual confirma que hay un grado de estructura poblacional muy alto, sugiriendo así, la existencia de una poblaciones por arroyo muestreado de la cuenca. Por lo tanto, se concluye que las poblaciones que habitan la cuenca alta del Río San Bernardino en Sonora, presentan información genética única y pertenecen a un importante acervo genético de la especie, por lo que es crítica la implementación de planes de manejo inmediatos para su conservación.

2012-11-16 11:00:00 **Immediate fish community responses to changes in habitat quality and resource availability following ash flows from the Whitewater-Baldy Complex Fire in southwestern New Mexico**

Whitney, James[*1], Gido, Keith[1], Propst, David[2]. (1-Kansas State University, Division of Biology, 2-University of New Mexico, Museum of Southwestern Biology).

Little is known about the effects of forest fires and subsequent ash flows on fish communities, owing to the general lack of pre-fire data. Even less well-understood are the impacts of historically-unprecedented forest fires, which are predicted to increase as a result of climate change and fuel load accumulation from fire suppression. The Whitewater-Baldy Complex Fire burned 120,534 hectares in the headwaters of the Gila River Basin in southwestern New Mexico during May 16th-July14th 2012, with a subsequent series of ash flows occurring between July 4th and September 14th 2012. The objective of this research was to examine the immediate effects of these ash flows on fish communities via their impacts on habitat quality and resource availability. Fish density and richness were measured at 9 ash flow sites and 4 non-ash flow sites during June, August, and October 2012. We quantified percent silt to assess changes in habitat quality and chlorophyll *a* concentration to evaluate resource availability change. Linear regression was used to examine relationships between changes in habitat or resources and fish community attributes. Between June and August, percent silt at ash flow sites increased an average of 119% (+/-69% SE), whereas percent silt decreased by 56% (+/-27% SE) at non-ash flow sites. During this same time period, chlorophyll *a* concentration decreased an average of 77% (+/-7% SE) at ash flow sites while only decreasing 14% (+/-14%) at non-ash flow sites. Fish density and richness exhibited decreases at ash flow sites, declining 17% (+/-19%) and 6% (+/-13%), respectively. Conversely, fish density and richness increased on average at non-ash flow sites by 29% (+/-51%) and 7% (+/-26%), respectively. Changes in fish density and richness were generally not explained by changes in habitat and resources however, with the only statistically-significant relationship exhibited between chlorophyll *a* change and fish density change ($F=5.58$; $p=0.04$; $R^2=0.32$). Investigation into other impacts of ash flows on fishes, such as alteration of water quality, coupled with long-term monitoring will be required to elucidate the overall impact of this catastrophic forest fire on the Gila River fish community.

2012-11-16 11:15:00 **Relationship between U.S.-Mexico border operations and total suspended sediment in headwaters of the Rio Yaqui.**

Clark, Stephani L.[1], Bonar, Scott A.[2]. (1-Arizona Cooperative Fish and Wildlife Research Unit, 104 Biological Sciences East University of Arizona Tucson, Arizona 85721, 2-U.S. Geological Survey, Arizona Cooperative Fish and Wildlife Research Unit 104 Biological Sciences East University of Arizona Tucson, Arizona 85721).

Impacts of U.S./Mexico border operations on many terrestrial species have been well documented, yet little is known about the impacts of border operations on aquatic ecosystems. Black Draw, a tributary to the headwaters of the Rio Yaqui, originates in San Bernardino National Wildlife Refuge (SBNWR) on the United States (U.S.)- Mexico border and is home to several species of threatened or endangered fishes. Construction of bridges and roads on or near SBNWR by U.S. Border Patrol, and other activities conducted by the U.S. Border Patrol, such as dragging roads to check for footprints and patrolling dirt roads in and around SBNWR, have prompted concern about increased sedimentation of the Rio Yaqui. Increased sedimentation could elevate total suspended sediment (TSS) and turbidity in the Rio Yaqui thus causing changes in diet and survival of fishes inhabiting the system. To evaluate impact of border patrol activities on TSS and turbidity in Black Draw, we installed Nalgene stormwater samplers, which collect single 1L first flush grab samples of storm water. Samplers were installed at randomly chosen sites, above and below three areas of border operations: The US/Mexico Border at Black Draw; The US/Mexico Border at Hay Hollow Wash; and the Black Draw Crossing at Geronimo Trail, a road in the United States which is graded to facilitate discovery of illegal border activity. Samplers were also located at additional random sites throughout Black Draw to identify major sources of sediment to the stream. Initial results show TSS concentrations ranged from 3.0mg/L to 67340.4mg/L and turbidity ranged from 0.6 nephelometric turbidity units (NTU) to greater than 10,000NTU. Turbidity and TSS concentrations are now being plotted and compared among locations in the drainage. Furthermore, these values are being used to identify a range of turbidity and TSS concentrations for which to test effects on Rio Yaqui fishes in laboratory experiments. Results will be used to inform management considerations involving turbidity, TSS and the imperiled fishes of the Rio Yaqui drainage.

2012-11-16 11:30:00 **Novel ecology, morphology, and rapid evolution within adaptive radiations of *Cyprinodon* pupfishes on San Salvador Island, Bahamas and Laguna Chichancanab, Mexico and direct field measurement of multiple fitness peaks on the pupfish adaptive landscape**

Martin, Christopher[*1]. (1-University of California, Davis).

Cyprinodon pupfishes display a remarkable pattern of adaptation across their wide range from Massachusetts to Venezuela to the inland deserts of California. Nearly all known species are opportunistic generalist foragers, feeding predominantly on benthic algae, and are found in allopatry relative to other *Cyprinodon* species, except in two places: San Salvador Island and Laguna Chichancanab. Three species coexist in the salt lakes of San Salvador Island, Bahamas. This 10,000-year-old radiation contains a specialized scale-eating pupfish, C. sp. 'bulldog', and a hard-shelled prey specialist, C. sp. 'durophage'. The latter species has evolved a novel trait: an anterior extension of the dorsal process of the maxilla which may help stabilize its jaws for prey-crushing. A second 8,000-year-old radiation of pupfishes coexists in Laguna Chichancanab, Mexico and contains the only known piscivore, *C. maya* and zooplanktivore, *C. simus*, pupfishes. I found that these two adaptive radiations are diverging in jaw morphology up to 50 and 130 times faster than background rates of evolution in other pupfish species using phylogenetic comparative methods. Thus, novel diets are driving rapid evolution in pupfishes, but why are adaptive radiations of pupfishes so rare across many similar isolated habitats? To address this question, I raised over 2,000 hybrids of the three San Salvador species in the lab, transported them to San Salvador Island, and measured their survival and growth in field enclosures. I experimentally confirmed multiple fitness peaks driven by increased competition in the wild. Hybrid phenotypes corresponding to the generalist C. sp. 'normal' sat atop an isolated fitness peak separated by a valley from a higher fitness peak corresponding to C. sp. 'durophage'. This suggests that most *Cyprinodon* species might be prevented from morphological diversification due to stabilizing selection which could explain the rarity of *Cyprinodon* adaptive radiations.

Las especies de *Cyprinodon* presentan un notable patrón adaptativo a lo largo de su rango de distribución, Massachusetts a Venezuela incluyendo los desiertos de Estados Unidos y México. Casi todas las especies conocidas son forrajeras generalistas oportunistas, que se alimentan principalmente de algas bentónicas, y se encuentran en relativa alopatría con otras especies de *Cyprinodon*, excepto en dos lugares: La Isla San Salvador y la Laguna Chichancanab. Tres especies coexisten en los lagos salados de La Isla San Salvador, Bahamas. Esta radiación de alrededor de 10,000 años de antigüedad contiene una especie lepidofaga, C. sp. 'bulldog', y un depredador de conchas duras, C. sp. 'durofago'. Esta ultima especie ha desarrollado un nuevo caracter: una extensión anterior del proceso dorsal de la maxila lo cual le permite estabilizar su mandibula para triturar sus presas. Una segunda radiación de especies cercana a los 8,000 años coexiste en la Laguna Chichancanab, México y contiene la única especie piscívora conocida de cachorritos, *C. maya*, y la zooplanctívora *C. simus*. Mediante el uso de métodos filogenéticos comparativos encontré que estas dos radiaciones adaptativas divergen en la morfología de la mandíbula de 50 a 130 veces más rápido que otras tasas de referencia de evolución en otras especies de cachorritos. Por lo tanto, estas nuevas dietas ocasionan una rápida evolución en los cachorritos, entonces porque son tan raras las radiaciones adaptativas en estos peces? Para responder a esta pregunta, produje mas de 2000 híbridos de las tres especies de San Salvador en el laboratorio y medí su tasa de sobrevivencia y crecimiento en encierros en La Isla San Salvador. Experimentalmente confirme múltiples picos de eficacia (fitness) ocasionados por el incremento de la competencia en el medio silvestre. Los fenotipos híbridos correspondientes a la especie generalista normal C. sp. 'normal' se ubicaron en un pico aislado de eficacia separado por un valle del pico mayor que corresponde a la especie C. sp. 'durofaga'. Consecuentemente, casi todas las especies generalistas de *Cyprinodon* pueden ver limitada su diversificación morfológica debido a la selección estabilizadora lo que puede ayudar a explicar porque son tan poco comunes las radiaciones adaptativas en *Cyprinodon*.

2012-11-16 11:45:00 **Winning the cattail battle**

Davis, Michael[*1], Parmenter, Steve[1]. (1-CA Dept. of Fish & Game).

Refuge persistence for Owens pupfish and Mohave tui chub, both federally listed endangered species, has historically been impacted by competition with non-native species and habitat loss. Early habitat modification methods aimed at recovery consisted, in part, of dam construction to provide isolation from non-native predatory fishes. This approach succeeded in avoiding the extinction of these species but did not lead to long-term refuge stability. Observations by our predecessors and us since 1969 suggest a link between increased water levels and loss of open water to dense emergent vegetation at refuge sites. Accompanying the spread of emergent vegetation was a perceived increase in non-native competitors and predators which were associated with population collapse. We have developed techniques to manipulate or replace emergent vegetation, leading to self-limiting plant communities, reductions in pest species, and longer-term viability for target species. This restoration model is applicable in both springs channels and ponds, and relieves some common problems encountered in the restoration of desert fishes and their habitats.

2012-11-16 13:30:00 **Warner Sucker investigations in the Warner Valley, Oregon**

Scheerer, Paul[*1], DeHaan, Patrick[2], Shaun, Clements[1]. (1-Oregon Department of Fish and Wildlife, 2-US Fish and Wildlife Service, Conservation Genetics Laboratory).

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. From 2006 through 2012, we conducted investigations to: 1) describe the current distribution of suckers in the Warner subbasin, 2) estimate their abundance in the lakes and streams, 3) collect life history information, and 4) describe the primary factors that currently limit the sucker's ability to maintain a functioning metapopulation, including connectivity or fragmentation of habitats and factors affecting successful recruitment in the lake and stream environments. In Crump and Hart Lakes, we found that the Warner sucker populations were severely depressed and recent abundance estimates in the lakes were some of the lowest on record. During the 2006-2010 drought, the lakes partially desiccated and we found little evidence of recruitment of suckers to the lake populations and noted a steady increase in the average size of lake suckers. In 2012, after the lakes re-filled, we documented successful sucker recruitment into the lakes and an increase in sucker abundance in Hart Lake. 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 and 2011, we described the distribution of Warner suckers in the Twentymile Creek subbasin and in Honey Creek, respectively, and obtained mark-recapture population estimates with improved precision. We used radio tracking, PIT-tagging, larval drift nets and downstream rotary migrant traps to assess seasonal movements of suckers. We found little evidence of substantial downstream movements in the spring and summer months. However, we documented large numbers of suckers moving upstream during the spring spawning period. We completed genetic analysis of sucker populations in four tributary streams. None of the tributary populations showed reduced levels of genetic variation and the data suggests that each tributary contains a genetically independent spawning population. We assessed levels of genetic variation in a refuge population and found them to be similar to those in the natural populations.

2012-11-16 13:45:00 **Use of remote PIT scanners to determine post-stocking fate of razorback sucker in Lake Mohave**

Kesner, Brian R.[*1], Karam, Abraham P.[1], Warmbold, Jerry[1], Pacey, Carol A.[1], Marsh, Paul C.[1]. (1-Marsh and Associates, LLC).

Passive Integrated Transponder (PIT) remote scanner systems were developed and deployed in Lake Mohave, Arizona and Nevada, to determine post-stocking fate of stocked razorback sucker *Xyrauchen texanus* in 2011 and 2012. Scanners were deployed among three zones within the lake; the riverine zone from Hoover Dam downstream to Willow Beach, an upper reservoir zone centered at Liberty Cove, and a basin zone centered around Yuma Cove. Known spawning sites were targeted in winter and spring, and additional aggregation sites were located in the river and investigated throughout summer. Totals of 3,262 and 8,330 scanning hours resulted in contact with 1,042 and 2,748 razorback sucker in 2011 and 2012, respectively. Scanning effort in the river zone was 61 and 53% of total effort in 2011 and 2012 respectively, and resulted in 70% of contacts both years. Total number of fish scanned in 2012 exceeded the most recent mark-recapture population estimate of 2,577 (1,139 – 6,284 95% confidence interval). The annual population estimate is based on annual roundup data, which does not include captures from the river zone. The razorback sucker population in the river zone was estimated at 1,785 based on remote PIT scanning data from 2011 and 2012. Results suggest the three zones are demographically isolated with only seven fish (0.6% of contacts) scanned in more than one zone in 2011 and 40 (1.1% of contacts) in 2012. Use of remote PIT scanning has provided nearly a ten-fold increase in number of contacts with repatriated razorback sucker in Lake Mohave, which will increase accuracy of demographic parameter estimates to support management recommendations that will help ensure long-term persistence of a genetically viable stock of adult razorback sucker in the reservoir. Future analyses of

post-release dispersal and survival for razorback sucker in Lake Mohave should include metapopulation dynamics given the apparent isolation of razorback sucker among zones.

2012-11-16 14:00:00 **Pupfishes of Chihuahua, how do your springs flow?**

Carson, Evan W.[*1], De la Maza-Benignos, Mauricio[2], Lozano-Vilano, Lourdes[3], Vela-Valladares, Lilia[2], Banda-Villanueva, Iris[2]. (1-Department of Biology, University of New Mexico, 2-Pronatura Noreste, A. C., 3-Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León).

There is a remarkable diversity of *Cyprinodon* species native or endemic to Chihuahua, Mexico. Within the last couple of decades, however, concern for these species and other aquatic species in the region has grown dramatically due to a vast, rapid and unsustainable expansion in water resource exploitation. In agreement with other recent surveys, these concerns were further heightened during field observations we conducted across Chihuahua in May 2011 and September 2012. The status and bleak outlook for many of these pupfishes will be discussed, as will recommendations for conserving remaining populations. Discussion will also include consideration of associated habitats and species.

2012-11-16 14:15:00 **Toward bioassessment without reference sites using species distribution modeling**

Hendrickson, Dean A.[*1], Labay, Ben[1], Cohen, Adam E.[1], Bonner, Timothy H.[2], King, Ryan S.[3], Kleinsasser, Leroy, Linam, Gordon[4], Winemiller, Kirk O.[5]. (1-University of Texas at Austin, Texas Natural History Collection, 2-Texas State University San Marcos, Aquatic Biology, 3-Baylor University Waco Texas, Department of Biology, 4-Texas Parks and Wildlife Department, River Studies Program, San Marcos, Texas, 5-Texas A&M University College Station, Department of Wildlife and Fisheries Sciences).

Use of least-disturbed sites for reference conditions in bioassessment can be subjective, is region-specific, and can contribute to management for steadily declining ecosystem health (shifting baselines). We explore an alternate approach to bioassessment that uses species distribution models to construct a fish community model across an environmentally diverse landscape (the entire state of Texas) to provide landscape-wide (at 1 km^2 resolution) reference state benchmarks of taxonomic completeness of fish communities. Using museum specimen-based occurrence records we constructed distribution models for 100 fish species to compare model-based predicted community composition against empirical fish community data from four independent surveys that independently sampled 269 sites broadly distributed across the study area. Two surveys had repeated-sampling protocols allowing for more rigorous model evaluation, and two had associated multimetric-based index of biotic integrity (IBI) scores and used methodologies characteristic of state and federal agency bioassessment efforts. Numbers of species predicted by the models were moderately to strongly correlated with observations from all surveys. Deviations were correlated in ways that indicate influence of species-specific prevalence, environmental quality, geographic patterns of species richness, and survey sampling intensity. We found significant, though weak, relationships between observed/predicted ratios and IBI scores. Site-specific values from the National Fish Habitat Assessment Plan (NFHAP) index showed weak and non-significant relationships to both our observed/predicted ratios and to IBI scores. The results of model-based assessment were similar to those of traditional methods based on reference sites, however, confounding influences of modeling artifacts contributed to over-prediction of richness that warrants further exploration. The model-based approach, especially in light of rapidly improving modeling methods, offers a promising heuristic platform for investigation and application of assessments at broad scales, and is immediately useful as a complement to traditional assessment methods.

2012-11-16 14:30:00 **Chemical removal of blue tilapia,*Oreochromis aureus*, from the South Fork of the Muddy River, Moapa, Clark County, Nevada**

Guadalupe, Kevin[*1]. (1-Nevada Department of Wildlife).

Chemical removal of blue tilapia, *Oreochromis aureus*, from the South Fork of the Muddy River, Moapa, Clark County, Nevada Blue tilapia, *Oreochromis aureus*, was first discovered in the Muddy River in 1991. Tilapia quickly invaded the Warm Springs area after dam removal in 1995. Tilapia has been reported to prey on native fishes including the Moapa White River springfish, *Crenichthys baileyi moapae* and the endangered Moapa dace, *Moapa coriacea*. Tilapia chemical removal was first attempted in the South Fork Muddy River on December 9, and 16, 2009. This barrier isolated headwater stream to the Muddy River was believed clear until tilapia were rediscovered during Moapa dace surveys on August 3, 2011. The South Fork of the Muddy River is a low gradient; low flow velocity impounded stream supplied entirely by numerous warm springs and seeps throughout. Thermal stream conditions combined with dense underwater and emergent vegetation makes it unfavorable to the mixing and carrying of rotenone throughout the system. Complex habitat increases the potential that rotenone did not reach lethal concentrations in all locations, resulting that some fish may have survived during rotenone applications in 2009. Intensive vegetation removal, reservoir application techniques, and four rotenone treatments spaced over two months in 2011 allowed for physical conditions to change, changing exposure conditions for the target fish. Adequate spacing also allowed potential tilapia eggs time to hatch and become vulnerable to subsequent treatments. Snorkel surveys throughout 2012 show that tilapia are currently absent from the South Fork of the Muddy River. Removal of tilapia is an essential step in removing threats to Moapa dace and other Muddy River native fishes.

2012-11-16 14:45:00 **Lampreys, an unexpected desert species: their conservation status along the Southern California coast.**

Reid, Stewart B.[*1], Goodman, Damon H.[2]. (1-Western Fishes, 2-U.S. Fish and Wildlife, Arcata).

Two species of lamprey are native to California south of Point Conception, the Pacific Lamprey, *Entosphenus tridentatus*, and an unresolved brook lamprey, *Lampetra cf. pacifica*, which is apparently extirpated from its known range in southern California. The North American range of the Pacific Lamprey extends from Alaska south to the Río Santo Domingo in northern Baja California, including records from many principal streams in southern California. However, recent coast-wide surveys of streams from Canada south to Baja California suggests that there is a major change in range and population dynamics south of Big Sur. While Pacific Lamprey ammocoetes (a freshwater-resident larval stage lasting about five years) are nearly ubiquitous from Big Sur northwards, they are now absent, or extremely rare, southwards, even at sites of recent collections and known populations. The mechanisms causing this pattern remain to be resolved, but include man-made passage barriers and anthropogenic changes in the environment, as well as natural habitat constraints, such as seasonal barriers to migration and arid conditions. Historically, there was also a freshwater-resident brook lamprey in the Los Angeles Basin, including the San Gabriel, Santa Ana, and Los Angeles drainages. However, the species has not been collected from its known range in the basin since 1955. One goal of the Pacific Lamprey Conservation Initiative is to increase awareness of lampreys in southern California streams

and explore approaches to their unique conservation needs.

2012-11-16 15:00:00 **Semper fidelis? Site fidelity and population turnover in suckers of the Southwest using PIT telemetry**

Booth, Michael[*1], Flecker, Alex S.[2], Hairston Jr, Nelson G.[2]. (1-United Water Conservation District, 2-Department of Ecology and Evolutionary Biology,Cornell University).

Movement of organisms within stream ecosystems is an important mechanism controlling an array of processes, including population dynamics, resource distribution, and the spatiotemporal effects of engineering taxa. Recent analyses suggest that movement has two components: displacement (large scale movement) and turnover (short distances) of individuals. Turnover of individuals is rarely considered in movement studies, but it can be important because it determines population structure and baseline population size for a particular habitat. We used stationary antennas and PIT (passive integrated transponders) tags to monitor individual habitat use and turnover of Sonora suckers (*Catostomus insignis*) and desert suckers (*Catostomus clarki*) within a 150-250m reach during 2009 and 2010. While a large number of tagged fish used our stationary antenna reach, only a limited subset of these fishes were consistently present. The population size of our focal reach was variable, ranging from 12 to >45 individuals. Turnover rates were variable from day to day, ranging from 0 to >65%. The few individuals that were consistently present in the focal reach still made extended (one or more days) departures from their home pools. However, some individuals displayed substantial fidelity to a particular habitat despite forays elsewhere, returning to the focal reach for the duration of the study.

2012-11-16 15:15:00 **Integrating molecular and archival approaches to uncover native diversity in cutthroat trout**

Metcalf, Jessica L.[1], Love Stowell, Sierra[2], Kennedy, Chris M.[3], Rogers, Kevin B.[4], Martin, Andrew P.[2]. (1-University of Colorado and University of Adelaide, 2-University of Colorado, 3-U.S. Fish & Wildlife Service, 4-Colorado Parks & Wildlife).

Effective conservation efforts require knowledge of species' historical diversity and distribution. For some species, many populations were extirpated or individuals moved beyond their native range before native diversity and distribution were documented, resulting in a lack of accurate information for establishing conservation goals. Moreover, traditional taxonomic assessments often failed to accurately capture phylogenetic diversity. We illustrate a general approach for estimating regional native diversity and distribution for cutthroat trout, *Oncorhynchus clarkii*, in the Southern Rocky Mountains. We assembled a large archive of historical records documenting human-mediated change in the distribution of cutthroat trout. We combined these stocking data with phylogenetic analysis of both 19th-century samples collected prior to trout stocking activities and contemporary DNA samples. Our study uncovered six divergent lineages of cutthroat trout in the Southern Rocky Mountains, two of which are extinct. A third lineage, previously declared extinct, was discovered surviving in a single stream outside of its native range. Comparison of the historical and modern distributions with stocking records revealed that the current distribution of trout largely reflects intensive stocking early in the late 19th and early 20th century from two phylogenetically and geographically distinct sources. Our documentation of recent extinctions, undescribed lineages, errors in taxonomy and dramatic range changes induced by human movement of fish underscores the importance of the historical record when developing and implementing conservation plans for threatened and endangered species.

2012-11-16 15:30:00 **Bonneville Basin Area Report**

Albrecht, Brandon[*1]. (1-BIO-WEST, Fisheries Section).

With many thanks to a number of co-authors (not all were available at the time of abstract submission, but to be presented and acknowledged during the presentation); this year's Area Report will provide an overview of activities and highlights associated with native aquatic species found within the Bonneville Basin. The June Sucker (*Chasmistes liorus*) Recovery Program continues to be very active with the propagation of June sucker from brood stock held at the Utah Division of Wildlife Resources (UDWR) hatchery facility at the Fisheries Experiment Station (FES), Logan, Utah. Record numbers of June sucker are returning to the Utah Lake tributaries to spawn. The least chub (*Iotichthys phlegethontis*) was petitioned to list in 2008, and the Fish and Wildlife Service's 12-month finding was released in June 2010 (warranted but precluded). The UDWR has been working diligently toward habitat creation and restoration for least chub, and some of these actions will be highlighted. The northern leatherside chub (*Lepidomeda copei*) was petitioned to list and recently subjected to a 12-month status review. In late 2011, listing of the northern leatherside chub was found to be not warranted. The states of Utah, Wyoming, Nevada, and Idaho and federal agencies formed the range-wide team for the northern leatherside chub, and this team continues to remain active. Founding of this team has spurred various sampling and management efforts pertaining to this unique species, and in Utah, Wyoming, and Idaho, several populations are being studied. For example, the UDWR recently and successfully introduced northern leatherside chub into Gold Hill Creek, a tributary of the Hayden Fork of the Bear River in Summit County, UT (within the historic range of the species), and have already documented successful recruitment as a result. The southern leatherside chub (*Lepidomeda aliciae*) team is active, and the Southern Leatherside Chub Conservation Agreement and Strategy is supported by signatory agencies solely within Utah. The UDWR and Utah State University (USU) are collaboratively conducting a study geared towards Bonneville cutthroat trout (*Oncorhynchus clarkii utah*) in the Weber River. This study is shedding light on interesting metapopulation dynamics of this charismatic and desirable native trout. Also in the Weber River, the UDWR continues to investigate the unique population of bluehead suckers (*Catostomus discobolus*) found there, and their population status will be updated. USU researchers have been monitoring and conducting a long-term evaluation of native and introduced fishes in the Logan River. These efforts have included population estimation, movement data collection, disease tissue sampling, and have benefited from public outreach and collaboration with stakeholders. Efforts on the Logan River, by USU, have also furthered the ecological understanding of mechanisms to help in the management of native species, particularly by providing insights into biotic resistance by native Bonneville cutthroat trout to the establishment of exotic brown trout. Overall, the outlook for native aquatic species in the Bonneville Basin has improved thanks to these and countless other efforts conducted during the past year.

2012-11-16 15:45:00 **Flooding likely affects Gila Topminnow population establishment in Fossil Creek, Arizona**

Pearson, Drewyer[*1], Robinson, Anthony[1], Crowder, Clayton[1]. (1-Arizona Game and Fish Department).

Between 2007 and 2011 the Arizona Game and Fish Department's Gila River Basin Native Fishes Conservation Program and its partners stocked Gila topminnow *Poeciliopsis o. occidentalis* annually into Fossil Creek as part of the second phase of the native fish restoration project with the goal of establishing self-sustaining populations therein. Even though 2,000 to 12,600 topminnow were stocked each year, few or none were detected during

monitoring each year. Possible reasons why topminnow seem so rare include: insufficient effort to detect rare species, negative interactions with other species, unsuitable habitat, or environmental events such as flooding. Of these, flooding was hypothesized to have the greatest impact on population establishment. For example, shortly after 3,000 topminnow were stocked in 2007, Fossil Creek experienced a flood likely exceeding 10,000 ft3/s; base flow in the creek is about 43 ft3/s. During post-stocking monitoring in 2008, no topminnow were detected. It may be that the population had not increased enough to withstand and recover from large-scale flooding. No large-scale flooding occurred during the winter of 2008-2009, and topminnow were detected during monitoring in spring 2009. An even more massive flood, likely exceeding 14,000 ft3/s occurred in January 2010, and no topminnow were detected during monitoring in summer of that year. However, no large-scale flooding occurred during the winters of 2010-2011 or 2011-2012, and topminnow were detected during monitoring in both 2011 and 2012. Both adult and post-partum topminnow were detected in 2011 and 2012, and topminnow were widely distributed in 2012. Gila topminnow may have increased in abundance enough that the population can persist past the next major flood event given that complex habitat that likely provides refuge during floods is moderately abundant in Fossil Creek.

2012-11-16 16:00:00 **Adult and juvenile razorback sucker (*Xyrauchen texanus*) research and monitoring on Lake Mead, Nevada and Arizona**

Rogers, Ronald [*1], Albrecht, Brandon[1], Kegerries, Ron[1], Shattuck, Zachary[1]. (1-BIO-WEST Inc.).

The recruitment, movement patterns, habitat use, and population trends of razorback sucker (*Xyrauchen texanus*) in Lake Mead, Nevada and Arizona were researched and monitored with funding provided by the Lower Colorado River Multispecies Conservation Program in 2012. In order to assess this unique, wild razorback sucker population, several methodologies were employed during the razorback sucker spawning season in 2012 including: sonic surveillance, trammel netting, nonlethal aging, and larval fish surveys. As evident from the data, Lake Mead razorback sucker demonstrated successful spawning in 2012. A total of 85 adults and 1 juvenile, wild and stocked aggregate razorback sucker were captured from four research/monitoring sites throughout the lake providing additional data to help document natural recruitment. Forty-nine new razorback sucker fin rays were collected for laboratory aging analysis and help to clarify recruitment patterns. To date, 710 unique individuals have been identified in Lake Mead, and a total of 395 fin ray sections have been collected and analyzed, helping to illustrate the continued recruitment of wild razorback sucker from 1978 through 2008. Aging data demonstrate that the 2005 year-class continues to be a strong year for natural recruitment in Lake Mead, and similar lake conditions in 2011 provides optimism that we will continue to find young, wild cohorts as they become susceptible to sampling gear during future monitoring efforts. Furthermore, adult movement patterns demonstrate that Lake Mead razorback sucker continue to utilize several areas of the lake during the spawning season. Observations of sonic fish movements from the Colorado River inflow area into the lower Grand Canyon lend further insight into the role that the river proper may play for this unique razorback sucker population. A pilot study was initiated in 2012 to focus on juvenile razorback sucker which should help to provide information regarding why Lake Mead razorback sucker are able to demonstrate natural recruitment. Continued research concentrating on this rare life stage should aid in the understanding of recruitment in Lake Mead. Research on Lake Mead may also have application elsewhere in the basin for the benefit and conservation of the species.

2012-11-16 16:15:00 **Consequences of an altered thermal regime for Colorado River native fishes**

Ward, David Lance[*1]. (1-USGS, Grand Canyon Monitoring and Research Center).

In the Colorado River in Grand Canyon a few species of native fish including humpback chub, *Gila cypha*, flannelmouth sucker, *Catostomus latipinnis*, and bluehead sucker, *Catostomus discobolus*, have managed to persist and even increase in abundance in recent years, despite overall declining trends for most other southwestern native fishes. One reason for this unique trend may be the constant low water temperature below Glen Canyon Dam caused by hypolimnetic water releases from Lake Powell. Although cold water year-round is known to be physiologically detrimental to native Colorado River fishes, it may also exclude warm water invasive species that have decimated native fish populations in other areas. When droughts occur, low water levels in Lake Powell allow for warmer water to be released from the epilimnion of the reservoir. Native Colorado River fishes with a long life span may be able to take advantage of rare drought induced warming events and produce strong cohorts that survive. The interval of drought induced warming may play a critical role in the persistence of native Colorado River fishes in Grand Canyon.

2012-11-17 08:30:00 **Detection, disease characteristics, and control of non-Tuberculosis Mycobacteria in hybrid Devils Hole pupfish**

Feuerbacher, Olin[*1], Bonar, Scott A[1], Barrett, Paul J[2]. (1-USGS Arizona Cooperative Fish and Wildlife Research Unit, University of Arizona, 2-U.S. Fish and Wildlife Service, Albuquerque, NM).

Non-tuberculosis mycobacteria (NTM) are important pathogens of both humans and aquatic organisms. Mycobacteriosis of fishes, sometimes termed “piscine tuberculosis” (PT), is a chronic disease of brackish, fresh, and saltwater fishes. An NTM species was isolated and cultured from hybrid Devils Hole pupfish, *Cyprinodon diabolis X C. nevadensis mionectes*. Clinical signs of PT in these fish included spinal curvature, swollen abdomen, emaciation, and lethargy. In advanced disease, dermal lesions were often present. PT was uniformly fatal in fish that developed skin lesions. Pathology showed granulomatous lesions could occur in any organ, but were most common in the spleen, kidneys, and liver. Vertical transmission of PT occurred despite removal of eggs from parental aquaria for incubation and hatching. PT was not effectively controlled by surface disinfection of eggs using either iodine at 100 mg/L or formalin at 1,667 mg/L of water. Incubation of the eggs in water containing the antibiotics chloramphenicol at 50 mg/L or trimethoprim sulfamethoxazole at 25 mg/L resulted in significantly reduced vertical transmission, and was successful in creating mycobacterium-free stocks. Longevity was also significantly increased in these fish. The antibiotics cephalexin at 6.6 mg/L and erythromycin at 12.5 mg/L were largely ineffective in preventing vertical transmission. Disinfection with iodine prior to antibiotic administration further enhanced the effectiveness of chloramphenicol and trimethoprim sulfamethoxazole in elimination of culturable mycobacteria from eggs, but this treatment significantly reduced 15 d survival of larvae. Neither the number of mycobacterium-positive eggs nor 15 d survival was affected by disinfection with formalin before antibiotic administration.

2012-11-17 08:45:00 **Upper Colorado Basin Area Report (2012)**

Breen, Matthew J.[*1]. (1-Utah Division of Wildlife Resources).

Activities continue in an effort to improve the status of imperiled native fishes of the upper Colorado River basin. These activities are guided principally by four programs: the Upper Colorado River Endangered Fish Recovery Program, 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 collectively work towards the recovery of Colorado pikeminnow, *Ptychocheilus lucius*, razorback sucker, *Xyrauchen texanus*, bonytail, *G. elegans*, and humpback chub, *G. cypha*, use the protection of in-stream 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 and increased effort towards removal of problematic nonnative species. Renovation of trout streams and reintroduction of the Colorado River cutthroat trout continues in Colorado, Utah, and Wyoming. 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. Following one of the wettest years on record, extreme drought conditions in the upper basin in 2012 have presented many challenges, most notably; widespread wildfires and subsequent flashfloods led to large-scale fish kills in several important drainages that serve as strongholds for native species.

2012-11-17 09:00:00 **Assessment of age-0 Colorado pikeminnow survival in backwater habitats in the middle Green River**

Skorupski Jr., Joseph A.[*1]. (1-Utah Division of Wildlife Resources).

Sampling of age-0 Colorado pikeminnow (*Ptychocheilus lucius*) has been conducted annually since the mid-1980s to assess the abundance and distribution of young fish. Since 1994, these surveys have shown a drastic reduction in the abundance of age-0 Colorado pikeminnow in the alluvial section of the Green River between Split Mountain and Desolation Canyon. However, studies monitoring the abundance of larval Colorado pikeminnow drifting from the Yampa Canyon spawning site during the same time, suggest that larval fish production has not decreased from previous levels when age-0 Colorado pikeminnow were more abundant in this reach. Several possibilities exist for why age-0 Colorado pikeminnow are not being caught as frequently as they once were, such as an increase in nonnative fishes. To address the possible influence nonnative fishes may have on age-0 pikeminnow, a blocking study was established in 12 separate backwater habitats. Backwaters include three treatments, all of which were initially depleted of nonnatives before the arrival of Colorado pikeminnow: (1) four control backwaters that will not be blocked after initial depletion; (2) four backwaters blocked by 1/4 inch mesh nets; and (3) four backwaters that are blocked by a 1/2 inch mesh nets. In general, blocked backwaters had a greater abundance of native fishes, with high growth rates. The blocking study will enhance our knowledge of ways to increase the survival of age-0 Colorado pikeminnow and other native species that utilize backwater habitats.

2012-11-17 09:15:00 **Consistent effects of predator removal on detritivores across a range of biotic and abiotic conditions**

Boersma, Kate S.[*1], Bogan, Michael T.[1], Lytle, David A.[1]. (1-Oregon State University, Department of Zoology).

Predator extinction is a significant mechanism by which a warming and drying climate may affect food web structure in aquatic communities. In arid-land aquatic habitats, fish and large-bodied invertebrate predators are especially vulnerable to climatic changes and stream drying, and several local extinctions of the predatory giant water bug *Abedus herberti* have been recorded across the southwestern United States. Here we report findings from two predator-removal experiments conducted during the dry seasons of 2010 and 2011. We seeded tanks with stream invertebrates and removed *A. herberti* as a treatment in both experiments, however several important correlates such as canopy cover and annual rainfall differed dramatically between years. Possibly as a result of these strong interannual abiotic differences, tanks from 2011 contained fewer species than tanks from 2010, regardless of treatment (mean tank richness: 11.55 and 19.75 respectively), and the effects of top predator removal on overall community structure were apparent in the diverse 2010 communities but not in the depauperate 2011 communities. Despite these differences, one consistent pattern emerged. In both years, top predator removal caused significant reductions in the abundance of the dominant detritivore, the sycamore caddisfly, *Phylloicus mexicanus*. Our study suggests that *A. herberti* plays a fundamental role in food web processes despite differences in year type and community composition, and its disappearance could slow the processing of organic material in arid-land streams across the region.

2012-11-17 09:30:00 **Cryptic diversity in giant water bugs (Belostomatidae: *Abedus herberti*): what this means for desert stream management**

Lytle, David A.[*1], Phillipsen, Ivan C.[1], Hartfield, Emily E.[1], Bogan, Michael T.[1], Boersma, Kate S.[1], Finn, Debra S.. (1-Oregon State University).

The giant water bug *Abedus herberti* is a large-bodied, flightless predator found in streams and rivers throughout deserts of Arizona, Sonora, and Chihuahua. *A. herberti's* low dispersal and strict habitat requirements make it a useful indicator of perennial water in drainages too small to support fish. Analysis of microsatellites and mtDNA from > 600 individuals spanning 20 populations indicates strong among-population differentiation, and suggests that rare dispersal events occur across headwater boundaries rather than within major catchments. These genetic results support previous experiments that found evolved differences in flood escape behavior (the ability to use rainfall as a cue to escape flash floods) across populations separated by only a few km of terrestrial habitat. This pattern of population-level isolation and adaptation to local stream conditions has implications for stream management actions, such as post-renovation restocking of invertebrates from other streams or the introduction of fish into previously-fishless streams. Some of these findings likely apply to *Abedus indentatus*, a similar species found throughout southern California and northern Baja California.

2012-11-17 09:45:00 **Status, distribution, and evaluation of headwater chub in Arizona**

Makinster, Andrew S.[*1]. (1-Arizona Game and Fish Department, Research Branch).

The Arizona Game and Fish Department (AGFD) recently developed a Conservation and Mitigation Program (CAMP) to off-set possible effects of the stocking program in regards to native fish. As part of this program, informational needs were identified in regards to the current status of headwater chub (*Gila nigra*; GINI) in 16 streams located throughout the state. Previous research on several of the streams was limited both spatially and temporally. Our research aimed to update these informational needs in the aforementioned streams. Status designations developed by Voeltz (2002; Nongame and Endangered Wildlife Program Technical Report 186. Arizona Game and Fish Department, Phoenix, Arizona, 228p.) were used to evaluate stream-specific GINI populations. A variety of gear types were used to sample these remote streams beginning in the summer of 2011 and lasting through 2012. Of the 16 streams sampled, we consider 12 to be stable-threatened, 2 to be unknown, and 1 to be unstable-threatened, with 1 stream yet to be sampled in 2013.

2012-11-17 10:00:00 **The reintroduction of the Rio Grande silvery minnow (*Hybognathus amarus*) into the Big Bend region of Texas and Mexico**

Edwards, Robert J.[1], Garrett, Gary P.[2], Remshardt, Jason[3], Roberson, Aimee[3]. (1-University of Texas-Pan American, 2-Texas Parks and Wildlife Department, 3-U.S. Fish and Wildlife Service).
The Rio Grande silvery minnow (*Hybognathus amarus*) is one of the most endangered fishes in North America and was first federally listed in 1994. Originally inhabiting the Rio Grande from Española, New Mexico to the mouth of the river near Brownsville, the species is currently found in approximately 5% of its former range in central New Mexico. The Recovery Plan for the species recommended that it be reintroduced into portions of its former range. The first experimental reintroductions of the species was approved and undertaken in December 2008. More than 2,000,000 minnows have been released in the Big Bend region in the past 5 years. The reintroduced fish have shown at least some survival at each of the sites and have been found considerable distances away from the reintroduction sites. Rio Grande silvery minnow eggs have been collected from two of the monitoring sites in 2010 and in August 2010, a 37 mm standard length juvenile Rio Grande silvery minnow was taken at one site, indicating some successful reproduction.

2012-11-17 10:15:00 **Historical stocking data and 19th century DNA reveal human-induced changes to native diversity and distribution of cutthroat trout**

Martin, Andrew[*1], Metcalf, Jessica[1], Love-Stowell, Sierra[1], Rogers, Kevin[2], Kennedy, Chris[3]. (1-University of Colorado Boulder, Ecology and Evolutionary Biology, 2-Colorado Division of Wildlife, 3-US Fish and Wildlife Service).
Many species are threatened with extinction and efforts are underway worldwide to restore imperiled species to their native ranges. Restoration requires knowledge of species' historic diversity and distribution. For some species, many populations were extirpated or individuals moved beyond their native range before native diversity and distribution were documented, resulting in a lack of accurate information for establishing restoration goals. Moreover, traditional taxonomic assessments often failed to accurately capture phylogenetic diversity. We illustrate a general approach for estimating regional native diversity and distribution for cutthroat trout in the southern Rocky Mountains. We assembled a large archive of historical records documenting human-mediated change in the distribution of cutthroat trout (*Oncorhynchus clarkii*) and combined these data with phylogenetic analysis of 19th century samples from museums collected prior to trout stocking activities and contemporary DNA samples. Our study of the trout in the southern Rocky Mountains uncovered six divergent lineages, two of which went extinct, probably in the early 20th century. A third lineage, the greenback cutthroat trout, previously declared extinct, was discovered surviving in a single stream outside of its native range. Comparison of the historic and modern distributions with stocking records revealed that the current distribution of trout largely reflects intensive stocking early in the late 19th and early 20th century from two phylogenetically and geographically distinct sources. Our documentation of recent extinctions, undescribed lineages, errors in taxonomy, and dramatic range changes induced by human movement of fish underscores the importance of the historical record when developing and implementing conservation plans for threatened and endangered species.

Muchas especies están en peligro de extinción y están realizando esfuerzos a nivel mundial para restaurar especies en peligro a sus áreas de distribución natural. Restauración permanecer conectado conocimiento de la diversidad de las especies y la distribución histórica. Para algunas especies, muchas poblaciones se han extinguido o individuos ido más allá de su área de origen antes de la diversidad nativa y distribución fueron documentados, lo que resulta en una falta de información precisa para el establecimiento de las metas de restauración. Además, las evaluaciones taxonómicas tradicionales a menudo no capturar con precisión la diversidad filogenética. Se describe un método general para estimar la diversidad regional y la trucha degollada nativas para su distribución en las Montañas Rocosas del sur. Hemos reunido a un gran archivo de los registros históricos que documentan humana mediada por el cambio en la distribución de la trucha (*Oncorhynchus clarkii*) y el análisis combinado de filogenética, que datan del siglo 19 con las muestras recogidas antes de las actividades de siembra de truchas museos y muestras contemporáneas de ADN. Nuestro estudio de la trucha en las Montañas Rocosas del sur descubierto seis linajes divergentes, dos de los cuales se extinguieron, probablemente en el siglo 20. Un tercer linaje, la trucha degollada dólar, previamente declarada extinta, fue descubierta sobrevivir en una sola corriente fuera de su área de distribución natural. La comparación de las distribuciones históricas y modernas con registros de siembra reveló que la distribución actual de la trucha refleja en gran medida la media temprana intensiva a fines del 19 y principios del siglo 20 a partir de dos filogenéticamente y geográficamente distintas fuentes. Nuestra documentación de extinciones recientes, linajes no descritas, errores en los cambios de la taxonomía, alcance y dramáticos inducidos por el movimiento humano de pescado pone de relieve la importancia de los antecedentes históricos y sviluppo al implementar planes de conservación de especies amenazadas y en peligro de extinción.

2012-11-17 10:30:00 **Incremental decreases in discharge of a thermal spring identify tipping points of non-linear environmental change, Death Valley National Park, California, USA**

Sada, Donald W.[*1], Morrison, Ryan[2], Stone, Mark[2]. (1-Desert Research Institute, Division of Hydrologic Sciences, 2-University of New Mexico, Department of Civil Engineering).
Springs are biodiversity hotspots in arid lands, where most of them are isolated from other aquatic systems and many are occupied by rare crenobiontic species. Most of these systems have been altered by anthropogenic activities and few remain in natural condition. Due to regional aridity and the paucity of surface water, southwestern U.S. municipalities and agriculture are increasingly reliant on groundwater. Many hydrologic studies examine the long term viability of groundwater resources but the incremental effects of decreasing spring discharge attributed to groundwater use or climate change on spring-fed aquatic environments and communities are unknown. Controlled field experiments were performed to quantify the effects of 10, 20, 40, and 60 percent reductions on physical and thermal characteristics of a springbrook by: (1) investigating effects on seasonal spatial temperature patterns using a combined hydraulic-temperature model; (2) quantifying changes in physical characteristics of the springbrook channel and aquatic environment, and (3) delineating tipping points that identify levels of decrease exhibiting a non-linear response to decreases. This springbrook environment changed rapidly following relatively small decreases. Tipping points for means and variances of springbrook wetted width, water depth, and habitat volume were associated with less than 20 percent decreases, and the thermal tipping point occurred with a 30 percent decrease during the springtime when daily air temperature variation was greatest. Changes in physical habitat may affect the aquatic ecosystem through several mechanisms. Springbrook length and wetted width describe the total area of substrate, the surface area of benthic macroinvertebrate habitat, and the amount of area receiving energy from allochothonous and autochotonous sources for primary and secondary production. This suggests that primary and secondary productivity may quickly decline, and benthic communities may quickly change, as discharge decreases. A study modeling the influence of decreasing discharge on benthic macroinvertebrates will be summarized in a future publication.

Los manantiales son lugares importantes de biodiversidad en las tierras áridas, donde la mayoría de ellos están aislados de otros sistemas acuáticos y

muchos están ocupados por unas especies manatiales obligatorias raras. Muchos de estos sistemas han estado alterados por actividades antropogénicos y pocos se encuentran en el estado natural. Debido a la aridez regional y la escasez del agua en el superficie, las municipalidades y los agricultores de la región sureste de los Estados Unidos están cada vez más dependientes de las aguas subterráneas. Muchos estudios hidrológicos examinan la viabilidad de largo plazo de los recursos de agua subterráneas, pero los efectos incrementales de la disminución de descarga de agua atribuidos al uso del agua subterránea o el cambio climático en los entornos acuáticos y comunidades están disconocidos. Experimentos controlados sobre el terreno se realizaron para cuantificar los efectos de unas reducciones de 10, 20, 40 y 60 por ciento en las características físicas y termales de un arroyo manatial por: (1) investigar los efectos en los patrones estacionales de temperatura espaciales usando un modelo combinado de temperatura hidráulica; (2) cuantificar los cambios de las caraterísticas físicas de un arroyo manantial y el entorno acuático; y (3) delinear los puntos de inflexión que identifican los niveles de disminución exhibiendo una respuesta no lineal a la disminución. Este ambiente manantial cambió rápidamente después de unas disminuciones pequeñas. Los puntos de inflexión de las medias y varianzas de la anchura mojada del arroyo, la profunidad del agua y el volumen del hábitat se asociaron con una disminución de menos de 20 por ciento y el punto de inflexción termal se produjo con una disminución de 30 por ciento durante la primavera cuando la variación diaria de la temperatura del aire fue mayor. Los cambios del hábitat físico podrán afectar el ecosistema acuática por algunos mechanismos. La longitud y la anchura mojada del arroyo describen el área total del sustrato, el área del superficie del hábitat de los macroinvertibrados bentónicos y la cantidad del área que recibe energía de fuentes alóctonas y autóctonas para la producción primaria y secundaria. Esto sugiere que la productividad primaria y secundaria podrán disminuir rapidámente y las comuniadades bentónicas podrán cambiar con rápidez mientras la descarga se disminue. Un estudio modelando la influencia de la disminución de descarga en los macroinvertibrados bentónicos se resumirán en una futura publicación.

2012-11-17 10:45:00 **Molecular ecology of mountain sucker in Western North America**

Douglas, Marlis[*1], Douglas, Michael[1]. (1-University of Arkansas Biological Sciences).

A combination of 2 mitochondrial (mt) DNA genes and 16 microsatellite DNA loci were employed to define distinct evolutionary lineages (ESUs) and demographically independent populations (MUs) in 847 Mountain Sucker [*Catostomus (Pantosteus) platyrhynchus*] across 57 sites (Colorado River Basin = 51; Bonneville Basin = 5; Columbia River Basin = 1; Missouri River Basin = 1). ESUs (N=4) were distributed primarily by basin (i.e., Missouri, Bonneville/ Snake, Colorado, River, and Price River within the Colorado River drainage). Haplotypes from the Price River may well represent a residual from ancient Lake Bonneville as they clustered with Missouri and Bonneville/ Snake basin haplotypes. Individuals were also assigned to 12 distinct adrainage-specific clades based upon multi-locus msat genotypes. However, only 9 of these qualified as demographically independent MUs in subsequent analyses (i.e., migrants/ generation

2012-11-17 11:00:00 **The use of native fishes for vector control**

Duncan, Douglas K.[*1]. (1-USFWS).

Western mosquitofish *Gambusia affinis* have been introduced world-wide, ostensibly for control of mosquito larvae. The negative impact of mosquitofish on native fishes across the globe is well documented. Other studies show mosquitofish also negatively impact tadpoles, newts, frogs, and aquatic insects. Several studies have demonstrated that mosquitofish carry parasites and disease that can be transferred into new areas. Lastly, mosquitofish are also known to cause cascading changes aquatic systems functioning. A need exists to provide mosquito control for public health and safety. While we can argue about the effectiveness and need for mosquito control, society demands it. So, any efforts to minimize the negative effects that flow from vector control are worthy ones. The use of native fish for mosquito control is rare, including the southwestern United States, and Arizona particularly. Gila topminnow *Poeciliopsis occidentalis* has been shown to be as effective for mosquito control as mosquitofish, as has the desert pupfish *Cyprinodon macularius*. The Arizona Game and Fish Department, U.S. Fish and Wildlife Service, and the U.S. Bureau of Reclamation in Arizona have championed the idea of using native fishes to control mosquitos. However, socio-political and regulatory hurdles are many. For endangered (and threatened) species like the Gila topminnow and desert pupfish, the hurdles are even greater, but not insurmountable. Despite these hurdles, the Arizona Game and Fish Department and U.S. Fish and Wildlife Service are attempting to facilitate the use of desert pupfish and especially Gila topminnow for mosquito control. We have a willing partner in Pima County's Natural Resources, Parks, and Recreation Department and the Health Department. Progress is slow. Because of climate change induced ecosystem changes, expanded mosquito populations and expanded mosquito seasons may occur in Arizona and the other southwestern United States. In addition, existing tropical and subtropical diseases, or novel diseases, may move north into these areas. The demand for vector control will increase, and we hope it can be accomplished with native fishes.

2012-11-17 11:15:00 **Chichencanaab pupfish species, an update**

Valdes Gonzalez, Arcadio[1]. (1-Facultad de Ciencias Biológicas, UANL).

The Chichencanaab lagoon is situated at the center of the Yucatan Peninsula, Northwest of Quintana Roo, constituted by a set of consecutive lakes in seven to 12 sections in a row flowing north to south of up to 30 km long and one km with of swamp at its best. It is the habitat of 7 Cyprinodon species with recent speciation, perhaps 8,000 years (Strecker, 2006). The cracking of the species has been suggested as of habitat isolation and/or niche partitioning process by specialization to different diets intakes. Recent global warming, together with touristic industry and urban development has made tremendous impact on the stability of the system and now threatens to vanish all species richness. The original purpose of this project was to gain understanding on the difficulties faced when several attempts were made to establish these fish under captivity, having lost all of them on several occasions, always due to micobacterial infection. The idea was to search for information on: are all these fish endangered, does these fish are infected from its origin or while in transit to the lab? For that reason we programmed a visit on the 15th- 20th of March 2011, with SEMARNAT permit No. SGPA/DGVS/00915/11. Dizuche and La Presumida Municipalities were visited at eight locations, 1) Extremo Norte, dried; 2) Buluckax, stagnant lagoon, low level, dried native mangrove (*Conocarpus erecta*) and aboundant cortadera (*Cladium jamaicense*); 3) Balneario Chichenkanaab, public park with low water level, dried shore vegetation; 4) Laguna de San Diego, water level very low, no water flow; 5) Villa Guadalupe cross road, the same situation, low water level, water not flowing; 6) Laguna La Esmeralda, same story, water not flowing, dried vegetation on former shore; 7) La Cenegosa was impossible to reach for lots of Cyperus grass invasion, the shores off limits, lots of deep mud; and 8) Santa Gertrudis Laggon, a former swamp now dried most of it, invaded by Cyperus grass locally called, la cortadora, at the end far away we could see an almost round bright green body of water surrounded completely by the same plant, local people called this area bad water and they assume it is a sinkhole or similar with underground water ways to the sea, for men and animals have been reported as lost and found away in the ocean. We found the location impacted by water loss even causing native mangrove vegetation to be dried, the shore bench one to two meters below the former zone, making water slow or not flowing, lots of biobild up material on the bottom (silt, mud, sludge, algae,) 30 to 70 cms deep, scum on top of the water, making it a very difficult for the fish to exist. The most common species found were *Cyprindon verecundus*, *beltrany* and *labiosus* at different locations, few *C. maya* at one location, few *C. simus* hybrids at the same spot, and *C. suavum* not found, perhaps completely lost for the type of feeding habits. We were able to collect a good number of fish, but many of them died very soon after collected, presenting diverse symptoms such as discoloration, bright color or red spots, belly swollen, popped eyes. The fish brought to the lab we made field imprint slides from the cloacal mucus, for further analysis on the lab. Two trios of *C. labiosus*, *C. beltrani*, and *C. verecundus* were carried to the lab, but were lost few days after arrival, not leaving any descendents. The imprints stained for Ziehl Neelsen gave positive results for *Mycobacterium spp.* , also some eggs, guts and

excreta were used to do mycobacterial cultures with positive results, preliminary chemical tests points to *Mycobacterium marinum*, further work is on the go with PCR to corroborate these results. Apparently Mycobacterial infection is enzootic on the entire region in advanced state, making the fish sick and prone to die after being collected. We recommend not doing any further fish sampling until two or three years have passed to see if the species could recover once the habitat is cleaned by storms and heavy rains, and hope for habitat recover.

2012-11-17 11:30:00 **Evaluation of augmentation as a recovery effort for Colorado pikeminnow, *Ptychocheilus lucius*, and razorback sucker, *Xyrauchen texanus*, in the San Juan River**

Duran, Bobby Ray[*1], Durst, Scott[2]. (1-USFWS, New Mexico Fish and Wildlife Conservation Office , 2-USFWS, San Juan River Basin Recovery Implementation Program).

The San Juan River is home to two federally endangered fishes, Colorado pikeminnow, *Ptychocheilus lucius*, and razorback sucker, *Xyrauchen texanus*. Altered flow regimes, habitat degradation and fragmentation, and the introduction and establishment of nonnative fishes contributed to the decline of these fishes. The San Juan River Basin Recovery Implementation Program (SJRIP) was initiated in 1992 to protect and recover populations of Colorado pikeminnow and razorback sucker in the San Juan River Basin while allowing water development projects to proceed in compliance with all applicable federal, state, and tribal laws. One management action used by the SJRIP is the augmentation of both species of endangered fishes with hatchery-reared fishes. Augmentation is intended to increase overall population numbers, provide opportunities for research (i.e., movement studies, habitat and spawning site preferences), add genetic diversity to the existing gene pool, and continue the persistence of a spawning adult population. We evaluated the success of the augmentation program by examining several factors. We looked at the number of fish stocked compared to the stocking goals and used the SJRIP's monitoring data to examine recaptures of stocked fish, retention and site fidelity, movement patterns and the increasing number of adult Colorado pikeminnow and razorback sucker captured in recent years. Collections of larval Colorado pikeminnow and razorback sucker confirm that reproduction is occurring in the San Juan River. Analysis of recapture data suggests that hatchery-reared Colorado pikeminnow and razorback sucker can survive in the San Juan River and that stocking can contribute in the re-establishment of these two endangered fishes in the San Juan River.

2012-11-17 11:45:00 **Spatiotemporal variation of Virgin River chub and Moapa speckled dace abundances in the Muddy River, NV**

Shattuck, Zachary[*1], Kegerries, Ron[1], Albrecht, Brandon[1], Rogers, Ron[1]. (1-BIO-WEST).

From 2007 to 2012, the Southern Nevada Water Authority (SNWA) contracted BIO-WEST, Inc. (BIO-WEST) to sample the Muddy River to determine the distribution and abundance of nonnative and native fishes, including Virgin River chub *Gila seminuda* and Moapa speckled dace *Rhinichthys osculus moapae*. For the past six years, sampling has been conducted from the Overton Wildlife Management Area upstream to the Bureau of Land Management (BLM) fish barrier twice annually (i.e., spring [April-May] and fall [September]). In sampling, a total of 968 Virgin River chub and 565 Moapa speckled dace have been captured in hoop nets, minnow traps, and/or seines; while nonnatives in aggregate combine for a total of 17,768 individuals in the same gears. Virgin River chub and Moapa speckled dace are the only two native fishes that are typically captured in these portions of the Muddy River, with the majority of these individuals found upstream of the Wells Siding Diversion. Seasonal variation in abundance has been observed for both Virgin River chub and Moapa speckled dace with well documented spatial variation, generally increasing from downstream to upstream reaches. Since 2010, Virgin River chub have been marked with passive integrated transponder (PIT) tags as part of a mark-recapture study to develop a population estimate comparable to estimates created by Scoppettone and others during the 1990s. Recaptured individuals moved as much as 5.6 km, increasing previously recorded maximum movement by more than 4.6 km. In the section of Muddy River from the Wells Siding diversion upstream to the Paiute diversion, a modified Lincoln-Peterson closed-model calculated in the program MARK estimated there to be a total of 270 Virgin River chub with confidence limits of 187 and 425. Continued long-term monitoring of Virgin River chub and Moapa speckled dace in the Muddy River will allow a better understanding of the relationships between abundance and habitat; while also allowing for the continued evaluation of the impact and threat of nonnative fishes.

2012-11-17 13:30:00 **Colorado River fish monitoring in Grand Canyon, Arizona: 2002-2011 humpback chub, *Gila cypha*, aggregations**

Persons, William R.[*1], VanHaverbeke, David R.[2]. (1-USGS Grand Canyon Monitoring and Research Center, 2-US Fish and Wildlife Service).

Humpback chub, *Gila cypha*, is an endangered cyprinid species endemic to the Colorado River basin of western United States. The species was described in 1946 by R. Miller from a specimen taken near the mouth of Bright Angel Creek, Grand Canyon National Park, Arizona; and was listed as endangered in 1967. Long term fish monitoring in the Colorado River downstream of Glen Canyon Dam is a component of the Glen Canyon Dam Adaptive Management Program. Monitoring for humpback chub in the mainstem Colorado River in Grand Canyon has been conducted sporadically since the 1970's, and has improved since the introduction of small motorized watercraft and the use of hoopnets and trammel nets. Nine humpback chub aggregations were originally identified based on fish collected during 1990 -1993, and closed population model abundance estimates were generated for six of those aggregations. An aggregation was defined as "a consistent and disjunct group of fish with no significant exchange of individuals with other aggregations, as indicated by recapture of PIT-tagged juveniles and adults and movement of radio-tagged adults". An open population model has been developed to estimate the population size of the aggregation centered at the Little Colorado River and the adult humpback chub population is estimated between 9,000 and 12,000 fish. We estimated abundance of humpback chub at aggregations by applying a uniform set of capture probability estimates to annual catches within the aggregations to estimate humpback chub abundance. The adult humpback chub population at eight mainstem aggregations, exclusive of the Little Colorado River aggregation, is estimated between 1,000 and 1,800 fish. There appears to have been an increase in 2010 and 2011 in the 30-mile, Shinumo, Havasu, and Pumpkin Springs aggregations compared to previous years. Shinumo and Havasu aggregations appear to have benefited from an ongoing program of translocations of young humpback chub to those tributaries.

2012-11-17 13:45:00 **Comparative survival of razorback sucker in lower Colorado River**

Patterson, Kristen[*1], Kesner, Brian[1], Marsh, Paul[1]. (1-Marsh & Associates, LLC).

Razorback sucker (*Xyrauchen texanus*) is one of four "big river" fishes endemic to the Colorado River basin. Once abundant in the system it is now listed as endangered. Today, its persistence in many reaches, like Lake Havasu, Arizona and California, relies almost entirely on stocking. Biannual netting and electrofishing efforts produce low recapture rates , providing limited insight into current population status, and what factors may be driving low survival in

stocked fish. Recent telemetry studies in Lake Havasu have found large spawning aggregations of razorback sucker in habitat unsuitable for standard net-based sampling that occurs in this reach. We deployed remote PIT scanners biweekly for the spawning period (January-early April, 2012) in fast flowing waters from Davis Dam downstream to Needles CA to contact a greater proportion of the population. We detected 763 individuals with PIT scanners and estimated the 2011 population to be 2659 (2069 to 3414, 95% confidence interval) individuals. Fish released in the largest size class, ≥ 500 mm, were contacted at a rate 3.2 to 10.3 times greater than fish released in any other individual 100-mm size class. Individuals also were significantly more likely to be contacted if released in spring than autumn (ANCOVA: P = 0.03, F-value =5.99). Results from multiple iterations of these combined efforts will form the basis for recommendations to adjust the stocking program to enhance razorback sucker survival in Lake Havasu.

2012-11-17 14:00:00 **Linking altered physical processes with fish life histories and habitat references to guide restoration planning in the San Rafael River, Utah**

Laub, Brian[*1], Budy, Phaedra[1], Jimenez, Justin[2]. (1-Utah State University, 2-BLM).

Habitat loss and population fragmentation are two of the main threats to native fish species in the Green and Colorado River basins. Habitat restoration within tributaries could increase habitat availability for native species and provide connectivity between tributary and mainstem populations. However, restoration goals should be based on an understanding of physical processes operating within the river system, so that restoration actions to improve habitat are sustainable within the current hydrologic and sediment regimes. The San Rafael River, a tributary of the Green River in east-central Utah, is being targeted for restoration because it maintains populations of three native fish species of management concern (collectively, the three species). Alteration of the flow regime and establishment of non-native woody vegetation (primarily *Tamarix*) along the lower San Rafael have led to a narrowing and simplification of the river channel and a loss of channel features such as point and gravel bars and floodplain backwaters. The lower section of the river is primarily a stable, low-velocity, sandy run or glide habitat. Life history requirements of the three species are not well matched to current conditions in the river, and surveys have demonstrated low population abundance of the three species throughout the lower San Rafael. Complete restoration of a wide, complex channel system throughout the entire lower San Rafael is unlikely given the current hydrologic regime. However, using the life history requirements of the native species and the continuous spatial configuration of fish habitat, it may be possible to target restoration actions at specific locations to aid physical processes in maintaining suitable habitat conditions (e.g., *Tamarix* removal at tributary junctions where the river is likely to be less stable and where coarse sediment is provided). In the meantime, ensuring connectivity to upstream and mainstem populations should be a management priority.

2012-11-17 14:15:00 **Conservation efforts for the endangered Moapa dace, *Moapa coriacea* at the Warm Springs Natural Area, Clark County, Nevada**

Syzdek, David J.[*1]. (1-Southern Nevada Water Authority).

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.

Soon after the property's acquisition by SNWA, Moapa dace numbers declined to a record low of 459 individuals. 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 the February 2008 nadir, dace numbers have been steadily increasing despite a human-caused wildfire in 2010 that burned over 600 acres of woodland near many of the streams that contain dace. NDOW and SNWA have subsequently treated the Upper Muddy River with rotenone to control the invasive and predatory blue tilapia (*Oreochromis aureus*). Furthermore, stream restoration and clearing of dense stands of invasive tamarisk (*Tamarix spp.*) and fan palms (*Washingtonia filifera*), is facilitating the re-establishment of native riparian vegetation, providing prevention of future wildfires, and continued improvement in Moapa dace numbers.

2012-11-17 14:30:00 **Larval trigger flows for Green River razorback sucker**

Speas, David W[1], Bestgen, Kevin R[2], Skorupski, Joseph A[3], Webber, Aaron[4]. (1-Bureau of Reclamation, Upper Colorado Regional Office, 2-Colorado State University, Larval Fish Laboratory, 3-Utah Division of Wildlife Resources, Northeast Region, 4-United States Fish and Wildlife Service, Colorado River Fish Project).

Recommendations for operation of Flaming Gorge Dam in northeastern Utah provide spring peak flows so razorback sucker *Xyrauchen texanus* larvae can access Green River floodplain wetlands, areas which provide favorable conditions for growth and survival. It was previously believed that timing spring peak releases from the dam to coincide with and augment the relatively unregulated Yampa River peak flow would provide wetland access for drifting larvae. Recent studies have shown, however, that this strategy provides the river-floodplain connection before most larvae are present. To maximize overlap between periods of larvae presence and wetland connection, captures of razorback sucker larvae in the Green River—rather than the Yampa River peak flow—was proposed as a trigger for increased spring flow releases from Flaming Gorge Dam. This larval trigger approach was implemented experimentally during the spring of 2011 and 2012. Extremely wet conditions in 2011 prompted dam managers to operate with dam safety as a top priority over endangered fish, but the period of floodplain connection nevertheless overlapped with razorback sucker larvae presence for a longer period of time than had been observed in the previous 19 years. Wetland sampling during autumn 2011 indicated that some of these larvae had been entrained into wetlands and survived their first summer, a rare and important observation. In contrast, 2012 proved to be exceedingly dry, and although larvae were successfully entrained into the few low elevation habitats that connected with the river, the spring peak volume and subsequent summer flow levels were insufficient to sustain these wetlands into autumn. Implementation of larval trigger flows in 2012 was successful because close real-time coordination between field biologists and dam managers resulted in flows which entrained razorback sucker larvae in designated wetlands. Moreover, valuable information on effects of larval trigger flows on razorback sucker was gained during extremely wet (2011) and dry (2012) conditions, and managers learned valuable lessons on the challenges of implementing larval trigger flows, particularly in dry years. Consistent with adaptive management principles, future experimentation may help define the role of larval trigger flows for recruitment of razorback sucker and refine management strategies as needed to promote recovery of this endangered species.

2012-11-17 14:45:00 **Lower Virgin River native fish monitoring: Population dynamics and**

response to high flows

Kegerries, Ron[*1], Albrecht, Brandon[1]. (1-BIO/WEST).

Since 1996, BIO-WEST, has sampled several reaches of the lower Virgin River to monitor general fish community dynamics, with an emphasis on woundfin (*Plagopterus argentissimus*) and Virgin River chub (*Gila seminuda*) populations in the lower Virgin River. A river-wide, long-term perspective of endemic, endangered, and native fish trends from 1998-2011 depicts a seemingly stochastic pattern of native fish catch rates throughout years and between biannual sampling events. Since large flood events were thought to impact the native fish community within the lower Virgin River, comparisons were made in native fish catch rates both before and after the large floods experienced in both 2005 and 2010. Spring 2005 native fish catch rates were reduced; however, there appeared to be increases in native fish catch rates through 2008 (post flood). Similar increases in catch rates of native fishes were found after the 2010 flood event; though, this increase occurred much sooner after flooding in 2010 than in 2005. Comparisons of nonnative fish catch rates reveal drastic declines in catch per unit effort during the spring 2005, as well as the spring 2011, post-flood sampling trips. Based on this data, native fish populations appear to show a positive response following high flow events, but we hypothesize that the fish community response is dependent on the timing, duration, and/or amplitude of flood events. Finally, we conclude that the impacts of low stream flow continue to hinder the success of native fishes in the lower Virgin River, but may not be the only limiting factor associated with the recovery of these unique species.

Entra texto de resumen en espaï¿½ol

2012-11-17 15:00:00 **FINS - A fisheries database for Arizona**

Stewart, William[*1]. (1-Arizona Game and Fish Department, Research Branch).

The Arizona Game and Fish Department has initiated the development of a Fisheries Information System (FINS) intended to build the data foundation to inform science-based decisions for fisheries management. One of the challenges to effective science-based decision-making in Arizona is the lack of a high-quality, accessible data that is continually updated over the long-term. Several data compilation efforts such as SONFISHES and Aquatic GAP (Kansas State) have been conducted in the southwest by different entities, but efforts unfortunately languish once key personnel leave. The FINS is a centralized database that is integrated within a Geographic Information System (GIS) and documented through detailed metadata. This database at a minimum includes georeferenced fish records, but where available also includes gear types, stocking records, habitat type, fish health information, etc. Unlike other efforts to date, AGFD will support FINS into the future, continually adding records as agency and non agency biologists complete surveys.

2012-11-17 15:15:00 **Lower Colorado River Area Report**

Robinson, Anthony[*1], Bunch, Aaron[1], Meyer, Kelly[1], Van Haverbeke, Randy[2], Richardson, Mary[2], Coleman, Stephanie, Carter, Codey[4], Blasius, Heidi[4]. (1-Arizona Game and Fish Department, 2-U.S. Fish and Wildlife Service, 3-U.S. Forest Service, 4-U.S. Bureau of Reclamation).

A wide variety of native fish conservation activities were completed in the Lower Colorado Area during the last year. In the Grand Canyon area, Arizona Game and Fish Department (AGFD) conducted annual native fish monitoring between Lees Ferry and Lake Mead. The typical species were captured: flannelmouth sucker, *Catostomus latipinnis*, bluehead sucker, *C. discobolus*, speckled dace, *Rhinichthys osculus*, and humpback chub, *Gila cypha*. The AGFD also monitored native fishes in the lower 1,200 meters of the Little Colorado River using hoop nets. The humpback chub and other native fish populations appear to be stable. Results of the U.S. Fish and Wildlife Service (USFWS) mark-recapture effort in the Little Colorado River also indicated that the humpback chub population has remained stable since spring 2008; the 2012 spring estimate was 5,327 (SE = 379) humpback chub >199 mm total length. The USFWS and National Park Service (NPS) also translocated about 200 juvenile humpback chub from the lower portion of the Little Colorado River upstream to above Chute Falls. An additional 700 juvenile humpback chub were transported to Dexter National Fish Hatchery and Technology Center to augment the captive population and to hold for grow-out and translocation to Havasu and Shinimo creeks in 2013. The Shinumo Creek humpback chub translocation project continued; so far 902 chub have been translocated into Shinumo Creek. Growth rates of juvenile chub in the creek exceed those in the mainstem Colorado River and meet or exceed those in the Little Colorado River. Emigration of chub from Shinumo Creek is high (>40%). The NPS and FWS also continued trout removal efforts in Shinumo Creek. Havasu Creek is the other humpback chub translocation project and 543 chub have been translocated to the creek since 2011. Growth rates of juvenile chub exceed those for the Little Colorado River, Shinumo Creek, and Colorado River. Some male chub released in 2011 were in spawning condition during the May 2012 monitoring trip, and high numbers were re-captured. The NPS continued to implement native fish conservation measures in Bright Angel Creek including installation of a weir at the mouth of the creek and three-pass backpack electrofishing depletion to capture and remove spawning trout. Weir captures were lower than previous years. During backpack electrofishing, 120 brown trout and 87 rainbow trout were removed, and 87 bluehead suckers and 3199 speckled dace were captured. In the Virgin River drainage, the Virgin River Program continued annual fall monitoring efforts in the Virgin River drainage and prepared for renovation of the Virgin River Gorge. With regard to monitoring, red shiner, *Cyprinella lutrensis*, were the most abundant species captured, followed by western mosquitofish, *Gambusia affinis*, speckled dace, flannelmouth sucker, desert sucker, C. clarki, Virgin River spinedace, *Lepidomeda mollispinis*, Virgin River chub, *Gila seminude*, black bullhead, *Ameiurus melas*, common carp, *Cyprinus carpio*, green sunfish, *Lepomis cyanellus*, largemouth bass, *Micropterus salmoides*, channel catfish, *Ictalurus punctatus*, and fathead minnow, *Pimephales promelas*. No woundfin were captured. The number of red shiners captured was relatively low compared to past sampling events. The Bunkerville diversion was again washed out during a flood. The diversion continues to be an area of vulnerability in the Lower Virgin River because it is not functioning as a barrier to upstream migration of nonnative fish. The renovation of the Virgin River Gorge was postponed because of AGFD concerns. The AGFD had a 15-month long moratorium on all piscicide applications in Arizona, which was lifted on June 6, 2012. The moratorium was put in place because of attempted state legislation to regulate the use of rotenone. During the moratorium a Rotenone Review Advisory Committee was formed which provided recommendations that were later accepted by the Arizona Game and Fish Commission. A new Arizona Game and Fish Commission policy governing use of piscicides was established, and the AGFD developed and adopted a Piscicide Treatment Planning and Procedures Manual. Immediately after lifting of the moratorium, administrative work began on two piscicide projects: the Virgin River and Fossil Creek. Because of the intense scrutiny by the state legislature, AGFD was very cautious in implementing these two projects. The Virgin River treatment called for treating at concentrations and durations that would have required a Special Local Needs permit, and the AGFD was unwilling to seek the permit for the first renovation project after lifting of the moratorium. As a result, the Virgin River Gorge treatment was postponed. In Lake Mead, razorback sucker, *Xyrauchen texanus*, monitoring was continued by BioWest. Downstream of Lake Mead, the Lower Colorado Multispecies Conservation Program partners stocked thousands of razorback suckers into three reaches of the Colorado River; 7,342 were stocked into Lake Mohave, 7,683 into the Colorado River to Lake Havasu, and 6,027 in the Colorado River below Lake Havasu. In the Gila River Basin a wide variety of activities occurred. With regard to repatriations, the AGFD, FWS, and BLM stocked Gila topminnow, *Poeciliopsis occidentalis*, into eight new sites (Buckhorn Spring in the Agua Fria drainage, Road Canyon Tank, Nogales Spring, and Little Nogales Spring in the Cienega Creek drainage southeast of Tucson, Ben Spring, Murray Spring, and Horse Thief Draw in the San Pedro drainage southeast of Tucson, and Usery Mountain Regional Park in Maricopa County). Gila topminnow were detected during the first post-stocking monitoring at each of these sites. Several previously repatriated sites were also stocked with additional Gila

topminnow: Fossil Creek, Bonita Creek, Redrock Wildlife Area in New Mexico, and the Phoenix Zoo. Gila topminnow were present detected at each of those sites in subsequent monitoring. Desert pupfish, *Cyprinodon macularius*, were stocked into one new site (Road Canyon Tank in the Cienega Creek drainage east of Tucson), two other sites were stocked in summer 2011: Murray Spring and Horse Thief Draw in the San Pedro River drainage southeast of Tucson. Desert pupfish were detected at each of these sites during post-stocking monitoring. Spikedace, *Meda fulgida*, and roundtail chub, *Gila robusta*, were stocked into a new site: the Blue River in eastern Arizona. And roundtail chub were also stocked into one other new site: Gap Creek a tributary to the Verde River. A number of the sites stocked in previous years are now considered to have established populations. For instance, Gila topminnow are now considered established in several locations: two ponds at Robbins Butte Wildlife Area, Spur Cross Conservation Area, Morgan City Wash, and Chalky Spring, and Fossil Creek. Desert pupfish are now considered established in two ponds on Robbins Butte Wildlife Area and two ponds in McDowell Mountain Regional Park. For a number of other sites, it is still unclear whether or not the repatriated native fish have established populations: spikedace, and loach minnow, *Tiaroga cobitis*, in Fossil Creek, Redfield Canyon, Hot Springs Canyon, and Bonita Creek, Gila chub, *Gila intermedia*, in the Lower San Pedro River Preserve pond, roundtail chub in Roundtree Canyon. The largest nonnative fish removal effort was the renovation of Fossil Creek during September 2012. Smallmouth bass, *Micropterus dolomieu*, invaded Fossil Creek in 2011, and numerous attempts to mechanically remove them were conducted, but then in spring of 2012 young of year smallmouth bass were detected in the stream, indicating that they had spawned. In September 2012 the portion of Fossil Creek between the two barriers was treated with rotenone twice. Native fish from upstream began colonization soon afterward, and a few of the threatened and endangered species were to be stocked into the renovated section. Two other nonnative fish removal efforts were conducted by AGFD and The Nature Conservancy in Redfield Canyon. One mechanical removal effort was conducted in March 2012, but only one green sunfish was observed and it eluded capture. During the second mechanical removal effort in June 2012, 45 green sunfish were removed. AGFD completed surveys of multiple Mogollon Rim streams for headwater chub, *Gila nigra*. Twelve of 16 streams sampled were considered to have stable headwater chub populations. AGFD also surveyed many of the Apache trout, *Oncorhynchus gilae apache*, streams in the White Mountain area of Arizona that were impacted by the 2011 Wallow Fire. During 2012 AGFD surveyed the South Fork, West Fork, and East Fork of the Little Colorado River, the Black River and Fish, Bear Wallow, Conklin, Soldier, Coyote, and Maime creeks. Two replicated Apache trout populations were lost, but Apache trout persisted, albeit in variable numbers, in the other streams. AGFD also mechanically removed nonnative trout from Conklin Creek. In addition, the Forest Service contracted out post-Wallow Fire surveys for loach minnow in the East Fork of Little Colorado River and Blue River. Few fish were found in the Blue River. The FWS uplisted spikedace and loach minnow to endangered status and critical habitat was designated in February 2012. The five-year review for both spikedace and loach minnow was completed. A spikedace and loach minnow recovery team was formed and began drafting a revised recovery plan. Bureau of Land Management (BLM) completed a variety of actions within the Gila River basin. They fenced out the upper end of Buckhorn Springs in 2012, and repaired fencing around Chalky Spring and Tule Spring. BLM also conducted fish surveys in Lousy Canyon, Larry Creek, Indian Creek and Silver Creek. The Safford Field Office continued efforts to mechanically remove green sunfish from lower Bonita Creek. They also conducted annual monitoring in Bonita Creek, the Gila River, Cold Spring Seep, Howard Well, and one site on the Little Colorado River. BLM and students from the local college, High School, and elementary school removed sedges from Howard Well and constructed a railroad tie stairway down the bank to improve habitat conditions in Howard Well. The BLM, Bat Conservation International, and Center for Wetlands and Stream Restoration also enhanced four wetland habitats and created a wetland habitat at Porter Wash. The BLM is also working to restore four acres of native grassland that borders a future native fish refuge in the San Simon River valley. The Bureau of Reclamation (BOR) funded a fish barrier was completed in the lower Blue River in eastern Arizona. After the barrier was completed, non-native piscivores were mechanically removed from the lower section of the river using snorkeling and spear-poles; 9 channel catfish and 1 green sunfish were removed. After the removal effort, 539 spikedace, 217 loach minnow, and 222 roundtail chub were stocked. Post-stocking surveys were scheduled for October 2012. Surveys of 49 of the tanks in the Blue River drainage were completed May thru July 2012, and fish (nonnative) were found in three; these three will be targeted for removal efforts. In New Mexico, New Mexico Game and Fish Department (NMGFD), the Forest Service, Kansas State University, and University of New Mexico surveyed warm-water reaches of the Gila River during August 2012, after some significant post-fire ash flows. Both loach minnow and spikedace were collected in the Gila River forks area and bird area. NMGFD and partners also salvaged Gila chub out of Turkey Creek, and loach minnow and from the San Francisco River; fish are being held at Dexter National Fish Hatchery. In addition, Gila trout, *Oncorhynchus gilae*, were salvaged from Spruce Creek and Whiskey Creek. Gila trout were also translocated from Langstroth Creek to McKenna Creek. Gila chub collected from Harden Cienega Creek in Arizona during March 2012 were stocked into Mule Creek in June 2011.

2012-11-17 15:30:00 **Loading the dice for Devils Hole pupfish (*Cyprinodon diabolis*)**

Wilson, Kevin P.[*1], Gaines, Bailey D.[1], Goldstein, Jeffrey[1]. (1-Death Valley National Park).

The population of the Devils Hole pupfish (*Cyprinodon diabolis*) continues to be below historical levels. The spring 2012 count was 63 with the majority of fish observed on the shallow shelf. This was the lowest count since the spring of 2008 (45 adults). From the spring of 2008 through the fall of 2011 the pupfish population seemed to have stabilized between 100-120 adults. In response to the unexpected decline in the spring of 2012, two status check counts were conducted in June revealing a population between 102 and 118 adults. A multi-agency decision was also made to discontinue Early-Life Stage (ELS, larvae) monitoring of the pupfish population and to target larvae pupfish with a timed feeding over the shallow shelf. Recent completion of an updated pupfish population model in collaboration with Iowa State University suggests that the population is most vulnerable at the egg and/or early larval life-history stage/s. Future experiments examining fecundity of hybrid (*C. diabolis* x *C. mionectes*) pupfish and survival of ELS hybrid pupfish will help strengthen this model. Recent research has focused on ecosystem energetics and microbial biofilm dynamics. For example, primary production estimates using dissolved oxygen readings between June 2008 and March 2010 ranged from 4-21 mg O2 L-1 d-1 with a significant decline over this time period, potentially due to a change in the microbial biofilm community. Ecosystem respiration ranged from 1.5-9.7 mg O2 L-1 d-1 and significantly increased over this same time period. Because microbial biofilms are important components of this unique ecosystem, shifts in their composition or activity may threaten ecosystem stability by reducing background O2 concentrations below the physiological limits of the endangered Devils Hole pupfish and the entire biotic community. Recent flood and earthquake disturbances will also be discussed.