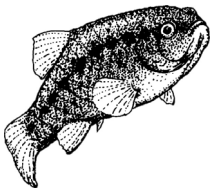

Desert Fishes Council

Consejo de los Peces del Desierto

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

Cuadragésimo Congreso Anual del Consejo de Peces del Desierto
40th Annual Meeting of the Desert Fishes Council

November 12-16, 2008

Oral Presentation Abstracts (in alphabetical order by first author)

(see page 18 for Poster Presentation Abstracts)

Lake Mead razorback sucker recruitment: An informative anomaly regarding continued, natural, wild razorback sucker recruitment despite nonnative fish presence

Albrecht, Brandon [1], Kegerries, Ron [1], Holden, Paul [1]. (1-BIO-WEST, Inc., Fisheries Section).

An ongoing razorback sucker (*Xyrauchen texanus*) research project on Lake Mead, Arizona and Nevada, has been funded by the Southern Nevada Water Authority and the U.S. Bureau of Reclamation for 12 years. This study continues to document the continued presence of actual, wild razorback sucker recruitment in the form of young, sexually immature individuals. This recruitment denotes the Lake Mead razorback sucker population as an anomaly in terms of razorback sucker persistence throughout the Colorado River drainage, despite similar non-native fish composition and densities as other locations. Fin ray aging data and back-calculation techniques have indicated that recruitment of razorback sucker on Lake Mead has occurred nearly every year. Furthermore, data collected have indicated that high lake elevations - those typically associated with maximum amounts of inundated terrestrial vegetation- appear to be responsible for pulses in recruitment. However, beginning with the 2007 spawning period, we have captured large numbers of juvenile/subadult, and adult razorback suckers that, based on back-calculation techniques, were spawned under low and declining lake elevations. In fact, the largest number of recruits observed to date now coincides with 2002, a low-water year which has produced 24 recruits thus far and has prompted a need to revisit our hypothesis regarding factors driving recruitment in Lake Mead. We believe that cover - both vegetative and in the form of turbidity - provides protection and food resources for larval and juvenile razorback sucker, thereby enabling them to avoid predation by nonnative sportfish present in the system. Interestingly, it appears as though turbidity (another form of cover) may be even more important that we have typically considered to date. As monitoring efforts continue, we would expect to begin capturing individuals spawned during 2007, 2008, and beyond. Continued monitoring efforts on Lake Mead should help ascertain if recruitment events continue, and perhaps begin to help understand more fully how to enable this unique trend in other locations. We suggest that Lake Mead provides a look at what naturally recruiting razorback sucker populations look like in the real world of nonnative predators and we suggest potential documentation of how functioning spawning aggregates are formed.

Evidence of young humpback chub, *Gila cypha* , overwintering in the mainstem Colorado River, Marble Canyon, Arizona

Andersen, Matthew E. [1], Ackerman, Michael W. [2], Hilwig, Kara D. [1], Fuller, A. Elizabeth [1], Abel, Angela A. [1]. (1-U.S. Geological Survey, Grand Canyon Monitoring and Research Center, 2-SWCA Environmental Consultants, Inc.).

Global climate change models predict that the southwestern United States will become warmer and drier, resulting in decreased reservoir volumes and increased water temperatures. These physical changes to aquatic habitats are further predicted to cause changes to native and nonnative fish distributions. Our observations of humpback chub *Gila cypha* allowed us to test predicted impacts of habitat changes on this federally listed endangered cyprinid endemic to the Colorado River Basin. Recent drought conditions in the southwestern United States have caused a lowering of Lake Powell, the reservoir created by Glen Canyon Dam, upstream of our Colorado River study site. The lower reservoir has, in turn, resulted in the release of warmer water between 2004 and 2006 than the twelve year running average that included the study period. We used bioenergetics models, laboratory swimming performance data, and river flow velocities to evaluate the potential that the young humpback chub we captured in 2006 and 2007 were hatched and reared up to 45 km upstream from the mouth of the Little Colorado River, the location where the majority of the humpback chub population below Glen Canyon Dam is hatched and reared. We determined that the most parsimonious explanation for our observations, especially for the largest fish we captured, was that the young humpback chub captured at our study site appear to have been able to take advantage of warmer water released from the dam by growing larger and faster, allowing them to overwinter upstream from the area where most of their congeners live. These results suggest that increased water temperature may be allowing humpback chub below Glen Canyon Dam to reproduce and rear in the mainstem Colorado River, upstream of their traditional natal tributary, the Little Colorado River.

Rehabilitation of School Spring, Ash Meadows, Nevada to improve habitat quality for Warm Springs pupfish, *Cyprinodon nevadensis pectoralis*, and its cohabiting thermal endemic invertebrates

Andress, Robert J. [1], McKelvey, Sharon [2], Baldino, Cristi R. [2], Weissenfluh, Darrick [2], Goodchild, Shawn C. [2], Scoppettone, Gayton G. [3]. (1-Otis Bay Ecological Consultants, 2-U.S.Fish and Wildlife Service, 3-United States Geological Survey).

School Spring is one of six low discharge thermal springs within the Warm Springs complex, on the Ash Meadows National Wildlife Refuge. Springs within the complex occur within a 500 m radius, and are sufficiently isolated from other Ash Meadows springs, to harbor their own endemic biota, premiere of which is the Warm Springs pupfish *Cyprinodon nevadensis pectoralis*. This unique biota is imperiled due to habitat alteration and invasion of non-native species prior to the area becoming a National Wildlife Refuge. Ash Meadows National Wildlife personnel have given the Warm Springs complex high priority for restoring its habitat and extirpating non-native species. Rehabilitation of School Spring is an important first step in restoring the Warm Springs complex to a semblance of its historic condition. The rehabilitation goal was to create habitat that would be a strong-hold for *C. nevadensis pectoralis* and its cohabiting endemic invertebrates while other Warm Spring complex spring systems are being restored. School Spring was selected for rehabilitation because its thermal endemic invertebrates had been previously extirpated and it had been serving as a *C. nevadensis pectoralis* refuge for the past 25 years. Our rehabilitation efforts included the removal of the deteriorating concrete ponds serving as the pupfish refuge; construction of a semi-natural stream channel in the vicinity of the historical spring outflow channel; improving the hydraulic and thermal conditions to accommodate thermal endemic invertebrates as well as *C. nevadensis pectoralis*; and eradicating non-native species. Monitoring to date indicates that the red swamp crayfish *Procambarus clarkii* and mosquitofish *Gambusia affinis* have successfully been eradicated from the system, and *C. nevadensis* pectoralis flourish. We are presently working on re-introduction of thermal endemic invertebrates.

Comparison of two methods for implanting passive integrated transponders in Rio Grande silvery minnow

Archdeacon, Thomas P. [1], Remshardt, W. Jason [1], Knecht, Tammy L. . (1-U.S. Fish and Wildife Service, New Mexico Fish and Wildlife Conservation Office).

Uniquely-tagged animals provide an opportunity to study changes in population demographics and movement. Passive integrated transponder (PIT) tags are used to monitor growth, movement, and survival of fishes. Laboratory studies of tag retention and fish mortality following insertion of PIT tags in small-bodied, warmwater cyprinids, are rare. Mortality induced by two PIT tag implantation methods was compared, and tag retention after implantation was assessed. The relation between standard length and tag retention, and standard length and fish survival, in Rio Grande silvery minnow *Hybognathus amarus* was examined. Captive fish were randomly selected and PIT-tagged with 12.5 mm tags via surgical incision or needle injection and held in laboratory aquaria for 32 d. Mean survival (±SE) on day 32 was 99% (±0.01) for control fish, 87% (±0.06) for fish implanted by incision, and 50% (±0.05) for fish implanted by injection. We also tagged 280 fish by incision and held them in aquaria for 49 days. On day 49, survival and tag retention were both 90%. Longer fish had higher survival, but tag retention was not related to fish size. PIT tags are a reliable method to tag Rio Grande silvery minnow, if fish are greater than 60 mm standard length.

Aquatic habitat restoration efforts on private lands in the upper Río Yaqui watershed, Arizona and Sonora

Austin, Valer [1], Austin, Josiah [1]. (1-Cuenca Los Ojos Foundation).

The San Bernardino Valley, a Río Yaqui tributary of southeast Arizona, USA, and northeast Sonora, México, was historically the site of a large ciénega (4 kilometers wide by 16 kilometers long) that harbored a unique assemblage of endemic and range-restricted endangered fishes. Fishes of interest here include the endangered Yaqui chub (*Gila purpurea*), Sonoran topminnow (*Poeciliopsis occidentalis sonoriensis*) and and Yaqui catfish (*Ictalurus pricei*), threatened Sonora sucker (*Catostomus bernardini*), Mexican stoneroller (*Campostoma ornatum*), an undescribed southern form of *Agosia* and others. A number of endangered and threatened aquatic invertebrates and plants also occur on the properties. Unfortunately, the ciénega and their biotic communities were severely damaged by a combination of drought, poor range management practices, and intensive farming. As vegetation was lost from the ciénega during the late 19th Century, intense periodic flooding accelerated erosion and formed head-cuts that slowly drained the majority of the wetland. The Cuenca Los Ojos Foundation (www.cuencalosojos.org), working with land owners and managers on both sides of the international border, is using a variety of restoration methods to recover the ciénega. These methods include: the installation of rock-and-wire gabions to slow flood waters, increase soil deposition, and permit establishment of vegetation in barren washes; extensive rehabilitation of existing wetlands and creation of new ones; and the restoration of uplands to help regulate the water cycle. These efforts have resulted in a dramatic increase in the extent of perennial wetlands, the establishment of vegetation that mediates the effects of floods, and the expansion of native fish populations. We further discuss some lessons learned throughout the process.

Polyphyly, hybridization, and cryptic biodiversity among *Micropterus* (Teleostei: Centrarchidae)

Bagley, Justin C. [1], Mayden, Richard L. [2], Roe, Kevin J. [3], Holznagel, Wallace [1], Harris, Phillip M. [1]. (1-University of Alabama, Biodiversity & Systematics, Department of Biological Sciences, 2-Saint Louis University, Department of Biology, 3-Iowa State University, Department of Natural Resource Ecology and Management).

Phylogenetic relationships and mtDNA variation among *Micropterus* were examined using complete sequences of the mitochondrial cytochrome b gene for 174 individuals from seven species, three subspecies, and an undescribed putative species. We tested (i) whether nominal species formed natural groups, (ii) whether intra- and interspecific relationships within *Micropterus* could be estimated with greater confidence with increased within-taxon sampling compared to results from increased character sampling regimes (i.e., Near et al., 2004, 2005), and (iii) for existence of new, potentially cryptic biodiversity within *Micropterus*. Eight major clades were obtained from maximum parsimony and maximum likelihood analyses: (1) *M. dolomieu*, *M. p. punctulatus*, and *M. treculi*; (2) *M. coosae* ('Bartram's bass') nested within a clade of *M. cataractae*; (3) *M. coosae* and *M. p. henshalli*; (4) *M. notius*; (5) *M.* sp. cf. *punctulatus*, eastern Gulf Coastal Plain (GCP) rivers; (6) *M. punctulatus*, GCP rivers just west of the Mississippi River + *M. treculi*; (7) *M. salmoides*; and (8) *M. floridanus* nested within *M. salmoides*. *M. coosae*, *M. floridanus*, *M. p. henshalli*, *M. p. punctulatus*, and *M. treculi* were recovered as poly-/paraphyletic. We found evidence for eight putative hybridization/introgression events: *M. dolomieu* × *M. p. punctulatus*, *M. p. punctulatus* × *M. p. henshalli*, *M. p. henshalli* × *M. coosae*, *M. cataractae* × *M. coosae*, *M. punctulatus* × *M. treculi*, *M. salmoides* × *M. coosae*, *M. salmoides* × *M. punctulatus*, and *M. salmoides* × *M. floridanus*. *M. floridanus*, a former subspecies of *M. salmoides*, and *M. dolomieu velox* were recovered nested within monophyletic groups of conspecifics and exhibited low (1-2%) sequence divergence suggesting they are not distinct at cyt b based on increased within-taxon sampling. In combination with recent data on *M. punctulatus* morphology, our results support cryptic biodiversity within this species in GCP rivers just east of the Mississippi River, where populations appear more closely related to *M. treculi* than other *M. punctulatus*.

Assessing hybridization between Yaqui catfish, *Ictalurus pricei*, channel catfish, *I. punctatus*, and blue catfish, *I. furcatus* using microsatellite markers

Baker, Sherri [1], Keeler-Foster, Connie [1], Radke, William [2]. (1-U.S. Fish and Wildlife Service, Dexter National Fish Hatchery and Technology Center, 2-U.S. Fish and Wildlife Service, San Bernardino National Wildlife Refuge).

The Yaqui catfish, *Ictalurus pricei*, has been reported in the Rio Yaqui drainage in Sonora, Mexico including San Bernardino Creek (Blackwater Draw) in Cochise County, Arizona. Currently the only existing wild populations can be found in the Rio Yaqui Drainage of Sonora, Mexico. Populations have been extirpated from the United States but have been reintroduced to the San Bernardino National Wildlife Refuge and West Turkey Creek in Cochise County, Arizona. Only three populations are known to exist in the U.S. portion of their range: Twin Pond (San Bernardino NWR), House Pond (Slaughter Ranch), and Big Tank (El Coronado Ranch). It is fairly certain that the Twin Pond and Big Tank populations are pure *I. pricei* but there is some concern as to whether the House Pond population has been contaminated by either blue catfish, *I. furcatus* or channel catfish, *I. punctatus*. The objective of this project was to genetically determine if the refuge population of *I. pricei* had hybridized with other *Ictalurus* species that may have been released into the pond.

Cultivo de truchas nativas en el Centro Acuícola Guachochi

Banda Cortés, Miguel [1]. (1-SAGARPA - Secretaria de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación).

Entra texto de resumen en español Debido a la ubicación Geográfica privilegiada en la que se encuentra el Centro Acuícola Guachochi, perteneciente a la SAGARPA (Secretaria de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación) desde hace algunos años adem´s de la producci&ocute;n de cr&icute;a de trucha arco iris (*Oncorhynchus mykiss*) para los productores del Estado de Chihuahua, fomentando la actividad acuícola y la generaci&ocute;n de empleos, se ha dado a la tarea de trabajar en el estudio de especies de trucha nativas que se encuentran en el estado, tratando de realizar su reproducci&ocute;n para lograr su conservaci&ocute;n y repoblar los lugares de origen que se encuentran en estos momentos en peligro de extinci&ocute;n, adem&ncute;s de concientizar de su importancia a la población que habita en lugares donde son originarios; son capturados por ellos mismos de una forma indiscriminada, utilizando t&ecute;cnicas y artes de pesca no apropiadas, adem´s de ser desplazadas por la actividad pisc&icute;cola cada vez m´s amenazante por la construcci&ocute;n de infraestructura en las cuencas en donde habitan estas especies. En este trabajo se presenta la experiencia con estas especies mostrando algunos resultados obtenidos en la reproducci&ocute;n y la adaptaci&ocute;n al cultivo, en colaboraci&ocute;n de varias Instituciones.

The state of Devils Hole and the Devils Hole pupfish in 2008

Barrett, Paul J [1], Bower, Mike [2], Wilson, Kevin P [2], Wullschleger, John [3], Sjoberg, Jon [4], Harris, Sean [4]. (1-U.S. Fish and Wildlife Service, 2-National Park Service, Death Valley National Park, 3-National Park Service, 4-Nevada Department of Wildlife).

At the 2007 Desert Fishes Council Symposium in Ventura California, representatives from the U.S. Fish and Wildlife Service, National Park Service and Nevada Department of Wildlife held an open discussion with the membership. Following this discussion and subsequent internal discussions within the three agencies as well as recommendations of the Recovery Team, several changes were made in the focus of the recovery program for the Devils Hole pupfish *Cyprinodon diabolis*. Past efforts focused on genetic analyses, disease identification, and captive propagation all of which were conducted away from Devils Hole. Although these disciplines remain important, we have shifted to understanding and manipulating the environment of Devils Hole itself. The captive propagation program has been relocated to the University of Arizona under the direction of Dr. Scott Bonar with the Cooperative Fish and Wildlife Research Unit. Until pure Devils Hole pupfish are available, the Unit will work with hybrid *C. diaboli x C. mionectes* fishes. Included in this work will be the culture of ostracods native to Devils Hole as a potential food for larval and juvenile growth. In addition to supplemental feeding of the pupfish in Devils Hole, we have or are in the process of, issuing contracts for a series of investigations into the biological and physical nature of Devils Hole including, a model of the physical mechanisms at work in Devils Hole, such as water temperature andturnover, examination of the physical tolerance and temperature acclimation of pupfish, quantitative habitat description of spawning locations on the shelf at Devils Hole, the isolation of eggs and larvae in floating live cars to avoid cannibalism and other predation, reevaluation of pupfish demographic data to develop more accurate methods, continued examination of the water quality parameters, research into the bacteria and other microfauna of Devils Hole and investigation of the N:P ratio and it's effect on algae and cyanobacteria growth and competition. Bi-weekly larval surveys of Devils Hole continue as does work toward the construction of a new refuge and propagation facility near School Springs on Ash Meadows National Wildlife Refuge.

Re-establishment of a population of Virgin spinedace, *Lepidomeda mollispinis mollispinis*, in upper Beaver Dam Wash, Nevada

Beckstrand, Mark [1], Sjoberg, Jon C. [2], Heinrich, Jim [3], Anderson, Cory [1]. (1-Nevada Department of Wildlife, 2-Nevada Department of Wildlife, 3-Oregon Department of Fish and Wildlife,).

The Virgin spinedace *Lepidomeda mollispinis mollispinis* is a plagopterine minnow endemic to tributary streams of the Virgin River system in Utah, Arizona and Nevada. Virgin spinedace were historically present in upper Beaver Dam Wash, Nevada but were extirpated from this stream reach after approximately 1963, corresponding with the construction of Schroeder Dam and Reservoir to develop sport fishing opportunities in Beaver Dam State Park. Efforts to re-establish spinedace in Beaver Dam Wash in Nevada by the Nevada Department of Wildlife began in 1995 but met with limited success until after spring 2005, when extreme high flow events in excess of 8,000 cfs led to the overtopping and breaching of Schroeder Dam and the removal of Schroeder Reservoir as a main stem impoundment in Beaver Dam Wash. Prior to 2005 spinedace were released in tributary and main stem stream habitats below the dam using fish translocated from lower Beaver Dam Wash with the assistance of Utah Division of Wildlife Resources and the Arizona Game and Fish Department, and showed limited evidence of reproduction and recruitment. After the 2005 flow events which scoured riparian habitats to pre-impoundment conditions and re-created access into additional habitat in and above the former reservoir impoundment, and coupled with the translocation of additional adult spinedace from lower Beaver Dam Wash in Utah and Arizona, spinedace have expanded adult presence into areas above the former reservoir and show increasing evidence of successful reproduction and recruitment into adult age classes. Although the 2005 flow events may have had a role in "re-setting" habitat conditions, Schroeder Dam and Reservoir may have had additional impacts to habitat suitability for spinedace beyond restricting access to upstream suitable habitats including thermal effects on downstream habitat suitability during typical summer low-flow conditions and interception of periodic maintenance flows essential to maintain aquatic habitat quality.

The Desert Fish Habitat Partnership: Striving for no more extinctions

Blasius, Heidi B [1], Boyer, Kathryn [1], Cantrell, Chris [1], Sjoberg, Jon [1]. (1-Bureau of Land Management, Safford Field Office, 2-USDA, Natural Resources Conservation Service, 3-Arizona Game and Fish Department, 4-Nevada Department of Wildlife).

Approximately half of U.S. threatened and endangered fishes occur in the arid western United States. State wildlife action plans identify habitat loss as a primary factor threatening aquatic species in desert ecosystems. Conservation of aquatic resources is a fundamental and pervasive challenge facing people and fish sharing increasingly limited waters of the arid west. The Desert Fish Habitat Partnership is mobilizing to address this issue. In light of global climate change and enormous population growth in western states, our challenge is daunting. Yet our goals are clear: no species will go extinct and no species will be added to the threatened and endangered species list.

Our objectives are simple: protect intact habitats by addressing threats and prioritize our efforts based on likelihood of success. We intend to meet these goals by integrating and implementing strategies and actions for desert fish identified in the state wildlife action plans of Arizona, California, Colorado, Idaho, Nevada, New Mexico, Oregon, Texas, Utah and Wyoming, multi-species conservation plans, or other species/habitat plans. Partners are poised to work across jurisdictions to focus dollars, expertise, and efforts on protecting intact desert fish habitats and restoring degraded ones. Yet with all the partners and conservation efforts in place, we still need your help. We need partners that are currently working on desert fish species to share data we can use to evaluate species and habitat trends, provide additional opportunities for leveraging money to accomplish our ambitious goals, and offer innovative ideas to expedite progress. Time is of the essence. This presentation will provide details of the emerging Desert Fish Habitat Partnership and offer participants the opportunity to join our efforts to protect and conserve desert fishes and their habitats.

Intraspecies interactions in giant water bug populations in drying intermittent streams

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

The intermediate disturbance hypothesis predicts that abiotic processes are more important than biotic processes at structuring natural communities in frequently disturbed systems, such as high relief drought-prone desert streams. However, there is evidence that populations of the giant water bug, *Abedus herberti*, in the intermittent streams of southeastern Arizona are subject to intense biotic interactions throughout the dry season as their prey base dwindles and cannibalism becomes prevalent. I present results of a study on intraspecies interactions in drying stream pools and experimental tanks. Isolated juveniles preferentially distributed themselves at the air-water interface at the edges of experimental pools, however this preference disappeared when more than one bug was present, suggesting strong effects of the presence of conspecifics, possibly resulting from cannibalism. Field studies confirmed a relationship between bug distribution and depth. Adults were found in pools with high surface areas and maximum depths, while juveniles were more evenly distributed throughout the reach. The selection of shallow, peripheral habitats by juveniles and deep, perennial habitats by adults suggests that an ontogenetic niche shift must occur, but the details of this transition remain unknown. As anthropogenic water use in arid lands increases, it is important to determine organism responses to intermittent streams during the drying season in order to create effective conservation plans for these ecosystems.

Isolated oases in the Sierra El Aguaje, Sonora, México: a biological inventory of aquatic animal species

Bogan, Michael T. [1], Noriega-Felix, Nohemí [2], Vidal Aguilar, Sylvette L. [2], Gutiérrez, Oscar [2], Alvarado, Andrés [2], Findley, Lloyd T. [3], Varela-Romero, Alejandro [4], Lytle, David A. [1]. (1-Oregon State University, Department of Zoology, 2-Centro de Estudios Superiores del Estado de Sonora, Hermosillo, 3-Centro de Investigación en Alimentación y Desarrollo-Unidad Guaymas, Sonora, 4-Departamento de Investigaciones Científicas y Tecnológicas, Universidad de Sonora, Hermosillo).

Desert spring systems support a remarkable diversity of aquatic organisms given their arid surroundings. The spring-fed oases of the Sierra El Aguaje are small patches of aquatic habitat and tropical vegetation isolated from one another by formidable volcanic cliffs and expanses of desert. This physical setting predicts that oases of this mountain range have great potential for high diversity and endemism of aquatic organisms. We quantified habitat types and sampled the aquatic biota of eight oases in the Sierra El Aguaje during spring and summer of 2008. We documented over 150 species of aquatic invertebrates and 4 species of aquatic vertebrates (2 frogs, 1 snake, and 1 fish) from 4 habitat types (riffle, seep, tinaja, oasis) among these 8 sites. Riffle, seep, and lentic (tinaja/oasis) habitat types each supported unique species and distinct communities of invertebrates. Additionally, these invertebrate communities are mainly of Neotropical origin and distinct from aquatic communities in other regions of Sonora (e.g., the Madrean Sky Islands). Preliminary examinations by taxonomic experts indicate that we likely collected several new species of invertebrates. The small sizes and isolation of these oases, combined with the reliance of many species on regionally rare and fragile microhabitats (e.g., riffles), make these systems extremely vulnerable to anthropogenic disturbance. Climate change and the rapidly-growing tourist destination of San Carlos both pose significant threats to this unique and diverse biota and we hope that our survey results contribute to effective conservation planning in the ecologically unique Sierra El Aguaje.

An overview of captive breeding methods for five imperiled desert chub and topminnow species

Bonar, Scott A. [1], Archdeacon, Thomas P. [1], Iles, Alison [1], Kline, S. Jason [1], Schultz, Andrew A. [1], Sontz, Erica [1]. (1-Arizona Fisheries and Wildlife Cooperative Unit, School of Natural Resources, University of Arizona).

Knowledge of captive breeding methods is important for conservation of highly imperiled species. Here we provide an overview of methods developed to successfully propagate five desert fishes: headwater chub *Gila nigra*; Gila chub *Gila intermedia*; Mohave tui chub *Gila bicolor mohavensis*; Yaqui chub *Gila purpurea* and Yaqui topminnow *Poeciliopsis occidentalis sonorensis*. Propagation was conducted in tanks and aquaria. Temperature and physical habitat manipulations were important for triggering reproduction in many of the species. Ceramic tiles covered with grating on the bottom of tanks served as chub spawning substrate, and protected recently-spawned eggs from parental predation. Chub eggs were then hatched in nearby rearing tanks. Refuges were used to successfully protect young topminnow from predation. The effects of feed types, fish density and optimal rearing temperatures on survival and growth were also investigated for larvae and juveniles of some of the chub species.

Habitat preferences and movement of three desert fishes in a highly altered stream: implications for maintaining viable populations

Bottcher, Jared L. [1], Budy, Phaedra [2], Thiede, Gary [3]. (1-Utah State University, 2-Utah State University, Utah Cooperative Fish and Wildlife Research Unit, 3-Utah State University).

An organisms' ability to disperse to suitable habitats across multiple life-history stages, especially in modified and fragmented systems typical of desert streams, influences individual fitness and overall population viability. The bluehead sucker, Catostomus discobolus, flannelmouth sucker, Catostomus latipinnis, and roundtail chub, Gila robusta, are three species native to the upper Colorado River Basin that now occupy 50% of their historic range, likely as a result of widespread habitat degradation, interactions with non-native species, and a mismatch between past adaptations and the current environmental template. Despite these declines, populations of all three species are present in the San Rafael River, a highly-regulated tributary of the Green River, Utah, providing an area of high conservation priority and an opportunity for research. Our goal is to determine the extent, timing, and environmental cues associated with movement, habitat preferences for each species and life stage, and limiting factors, ultimately to guide effective management and recovery of these species. In 2007-2008, we sampled fish using a variety of methods from 25 systematically-selected, 300-m reaches in the lower 64 km of the San Rafael River, spaced to capture the range of species, life-stages, and habitat conditions present. We implanted all target species with a passive integrated transponder (PIT) tag, installed a passive PIT tag antennae, and measured key habitat parameters throughout each reach and at the site of native fish capture. Multiple age-classes of each species were collected in the San Rafael River, with the highest total densities occurring in complex habitats near the confluence with the Green River and in the most upstream reaches of our research area. Flannelmouth sucker were habitat generalists, whereas bluehead sucker and roundtail chub actively selected for riffles and pools, respectively. These discrete channel units, along with important rearing habitat (e.g. backwaters, eddies) are relatively rare in the lower San Rafael River, possibly limiting recruitment and overall population viability. Both local (50 km) movement is pervasive for the entire Colorado River fish assemblage, as all but one recaptured individual (passive and active) was captured at a location different from the initial tagging location. The abundance of age-0 and juvenile fish throughout the sampling period, along with a significant peak in adult downstream movement after the spawning period, suggests that the San Rafael River may provide important spawning and rearing habitat for several sensitive species. These results will allow us to better understand the importance of tributaries and complex habitats for native fish persistence and provide the first step towards completing population viability analyses within a spatially-explicit framework.

Conservation strategies for the Conchos trout

Brooks, James [1]. (1-Truchas Mexicanas).

Truchas Mexicanas reported on the 2005 re-discovery of the Conchos trout and made a call for immediate conservation efforts in a white paper written in 2006. Extensive survey efforts by Truchas Mexicanas for the approximate ten preceding years demonstrated the extreme rarity of this species and identified a number of conservation strategies necessary to protect the species from extinction. Originally collected in the 1880s by explorer Nathaniel T. Lupton, this rare endemic trout of the Rio Conchos Basin has persisted in a few isolated streams of the northeastern Sierra Madre Occidental, Chihuahua, México. Information is presented on the known current distribution of the Conchos trout, including results of survey efforts since 2005. Conservation strategies for short- and long-term application to prevent species extinction are identified. An overview of the management plan for protection of Conchos trout at Ejido Panalachi is also presented. Important participants in Conchos trout conservation include, along with Truchas Mexicanas, include World Wildlife Fund – Mexico and Trout Unlimited and their efforts are identified within the Ejido Panalachi efforts.

The status of Zuni bluehead sucker: Are our efforts working?

Carman, Stephanie [1], Luna, Nelson [2]. (1-New Mexico Department of Game and Fish, 2-Pueblo of Zuni Fish and Wildlife Department).

Zuni bluehead sucker *Catostomus discobolus yarrowi* is currently restricted to headwater habitats, totaling less than 5 km, of the Zuni River in west-central New Mexico. Primary threats include predation and competition from nonnative fishes and crayfishes, loss of habitat because of water and land development, and diminished genetic diversity. Drought has also reduced habitat and consequently abundance and distribution of Zuni bluehead sucker. Tribal, state, and federal agencies, private landowners, and non-profit organizations are utilizing a variety of conservation methods to decrease these threats and improve populations and habitats. Current activities include establishing refuge populations, assessing genetic variability, removing nonnative species, and influencing local land-use decisions. Despite considerable effort, conservation activities have failed to secure the species: population data continues to decline and it is arguably more imperiled today than it was 15 years ago. Conservation of Zuni bluehead sucker will require protection of water sources of the Zuni River watershed, its restoration to historical range, elimination of invasive species, and heightened awareness of threats and commitment to appropriate corrective actions by agencies and individuals.

The reintroduction of five native fish species into Ash Creek Arizona: Partnerships and policy change

Carveth, Cori [1], Cantrell, Chris [2]. (1-Golder Associates Inc., 2-Arizona Game and Fish Department).

In fall 2007 five native fish species were reintroduced to Ash Creek, a small perennial stream which flows into the Salt River, Arizona. Despite the fact that this stream was fishless, required no chemical renovation, and was solely located on federal land, this project took over 5 years to complete and faced significant hurdles during the implementation. This project brought to light the challenges that internal policy created for native fish reintroductions in Arizona and ultimately created a policy change that will make future native fish reintroductions more feasible. Lesson learned focus on the benefits of working cooperatively with multiple government agencies and involving the public in early planning.

Reintroduction of an extinct fish, the Apodaca Monterrey Platy (*Xiphophorus couchianus*) in its natural habitat

Chavarria Gallegos Sr., Roberto [1], Gomez Garza Sr., Miguel A. [1], Valdes Gonzalez, Arcadio [3]. (1-Consejo Mexicano de Peces del Desierto, 2-Centro de Resguardo de Especies en Peligro).

The Monterrey Platy (*Xiphophorus couchianus*) used to occur in Huasteca Canyon and disappeared in the mid 1960's, but populations of the species survived until the 1990's, in Ojo de Agua de Apodaca, in the municipality of Apodaca in the Río Pesquería drainage. We accomplished the first reintroduction of this extinct-in-the-wild subspecies, after years of maintaining it in captivity and negotiating the reintroduction with authorities. Now we are now working with the local government and the local population on a campaign to establish an environmental ethic to help guarantee this species will survive into the future.

Morphological variation, genetic structuring, and stable isotopic signatures in the Utah Lake, Utah sucker complex

Cole, David D. [1], Cardall, Brian L. [2], Mock, Karen E. [2], Crowl, Todd A. [1]. (1-Utah State University, Ecology Center and Department of Watershed Sciences, 2-Utah State University, Department of Wildland Resources).

Population decline in the federally endangered June sucker, *Chasmistes liorus*, a lakesucker unique to Utah Lake, Utah, has been attributed in part to hybridization with the more widespread Utah sucker, *Catostomus ardens*. Meristic and morphological ambiguities, presumably the result of hybridization, create a continuum of intermediate forms between Chasmistes and Catostomus extremes and prevent definitive identification to species. Here we describe and evaluate the morphological and genetic variation in suckers in Utah Lake by comparing a morphological analysis with amplified fragment length polymorphism (AFLP) and microsatellite analyses; additionally, we use stable isotopes (^{13}C and ^{15}N) to compare sucker diet along the morphological gradient. Suckers were differentiated using mouth characters associated with different presumed feeding strategies: planktivory (June sucker) and benthivory (Utah sucker). Although we found no genetic evidence for a deep divergence between June and Utah morphs, slight, but significant, population structuring accompanied the substantial morphological variation. Bayesian model-based genetic clustering detected two sucker populations in Utah Lake, though these clusters were only weakly concordant with morphological groupings or between marker systems. Stable isotopic signatures were congruent with the presumed feeding strategies. The suckers in Utah Lake present an interesting dilemma regarding conservation: should one conserve (breed and stock) a subset of the morphotypic variation in the Utah Lake sucker complex, focusing on the endangered June sucker morphotype, or should one conserve both June sucker and Utah sucker morphotypes in this complex, possibly maximizing evolutionary potential?

Adaptive radiations in *Cyprinodon* body shape explained by salinity and other ecological factors

Collyer, Michael L. [1]. (1-Stephen F. Austin State University, Department of Biology).

Morphological variation of euryhaline fish species occurring in diverse habitats is typically associated with greater streamlining in saline environments. Past studies of *Cyprinodon* morphology have identified body shape divergence associated with salinity variation among environments where different populations of the same species occur. In the current study, I performed a broad-scale morphological survey from museum collections of six species of *Cyprinodon* occurring in diverse habitats. Body shape was quantified with geometric morphometric methods and model comparisons were performed to elucidate the ecological variables that are most important in explaining Cyprinodon body shape variation. Additionally, I considered whether (1) species differences or ecological variation was more important for explaining shape variation and (2) how recent morphological divergence compares to deeper phylogenetic variation in body shape. Results indicated that salinity is an important factor for explaining shape variation associated with streamlining both within and among species, but other ecological factors are also important. Further, ecological variation in body shape within species was much more pronounced than species differences in body shape. These results suggest that adaptive radiations of *Cyprinodon* in ecologically disparate environments were substantial.

Expanding native trout conservation from the Conchos headwaters to the northern Sierra Madre Occidental in México

Cortés Montaño, Citlali [1], Ramos Gómez, Mauro [2], Brooks, James E. [3], Smith, Nick , Zapata López, Jenny [4]. (1-Northern Arizona University, School of Forestry, 2-Comisión Nacional de Áreas Naturales Protegidas - Dirección Regional Norte y Sierra Madre Occidental, 3-U.S. Fish and Wildlife Service, New Mexico Fish and Wildlife Conservation Office, 4-World Wildlife Fund - Programa Desierto Chihuahuense).

Recent native trout conservation efforts in northwest México are truly interdisciplinary, bringing together practitioners from different fields in biology, management and policy making as well as local communities and authorities. This presentation will summarize the lessons learned from the Conchos aparique conservation program implemented by a partnership involving the World Wildlife Fund, Trout Unlimited, Truchas Mexicanas, the United States Fish and Wildlife Service, the Comisión Nacional de Áreas Naturales Protegidas and other government agencies, local people and authorities of ejido Panalachi. We will proceed to present threats to trout populations in the Sierra Madre Occidental, as well as proposals to reduce or minimize them. We will also provide an update of current native trout conservation actions in the state of Chihuahua and recommendations on priorities and lines of work for conservation of native trout species from Northwest México. Our experience with the Conchos aparique conservation program shows that partnerships involving local communities, all levels of government and non-governmental organizations are a successful model for conservation efforts in the short term. However, we are convinced that it is also urgent to create a policy framework that includes legal mechanisms that will guarantee the long term survival of these endangered fishes.

Sex ratio and density alter male mating strategies in the coercive livebearing mosquitofish (*Gambusia affinis*)

Cureton II, James C. [1], Martin, Rachel [2], Deaton, Raelynn [3]. (1-Sam Houston State University, Department of Biological Sciences).

Both operational sex ratio (OSR) and density fluctuations can cause sexual conflict to arise in many systems. The western mosquitofish, *Gambusia affinis*, is an ideal organism for investigating sexual conflict because males of all sizes coerce (force copulate with females). In this experiment, we hypothesized that both OSR and density would influence male mating and aggression. Specifically, we predicted that (1) males will attempt to mate with all available females as OSR becomes more female-biased and density increases, and 2) male aggression will increase as the OSR becomes more male-biased and as density increases. In this study, we used two approaches: first, we observed one focal male (N=40) across all densities (two and four) and all sex ratios (4:0, 3:1, 1:1, and 1:3) to assess shifts in individual male behavior; and second, we observed focal males, across all sex ratios at two different densities (two and four) in a repeated measures design (N=20 males per sex ratio treatment). When one male was observed across all treatments, copulation attempts and female harassment did not vary across sex ratio or density, but the male mated with more females as the number of available females increased. When different males were observed across the two densities, copulation attempts and the number of females mated with increased as the sex ratio became more female-biased and as density increased. In both analyses, males became more aggressive as the sex ratio became more male-biased. Both approaches suggest that males attempt to fertilize more females as the sex ratio becomes more female-biased. In female-biased sex ratios, males have less aggressive interactions and spread their copulations across several females, thereby maximizing their reproductive success.

Native fish conservation, and management in the upper/middle Rio Grande basin, Pecos River, Canadian River, Tularosa and Guzman basins, New Mexico during 2007 and 2008.

Davenport, Stephen R. [1], Brooks, James E. [1], Remshardt, W. Jason [1], Propst, David L. [2], Zymonas, Nik D. [2], Carman, Stephanie M. [2], Platania, Steven P. [3], Brandenburgh, W. Howard [3]. (1-U.S. Fish and Wildlife Service, 2-New Mexico Department of Game and Fish, 3-American Southwest Ichthyological Researchers).

Native fish conservation in New Mexico is accomplished through long term monitoring of protected species, captive propagation, stream restoration, salvage of fish from dry river reaches, and interagency water management. Long term monitoring programs track abundance of Rio Grande silvery minnow (*Hybognathus amarus*) in the Rio Grande, New Mexico, Pecos bluntnose shiner (*Notropis simus pecosensis*), gray redhorse sucker (*Moxostoma congestum*), and blue sucker (*Cycleptus elongatus*) in the Pecos River, New Mexico. Rio Grande silvery minnow were salvaged from dry river sections by the U.S. Fish and Wildlife Service (USFWS), New Mexico Fish and Wildlife Conservation Office. The wild population was augmented with propagated fish from Dexter National Fish Hatchery and Technology Center and Albuquerque Biological Park. Bigscale logperch (*Percina macrolepida*) monitoring begun by USFWS in 2007 continues in 2008. A Pecos River restoration project at Bitter Lake National Wildlife Refuge will reconnect oxbows to river flow, remove salt cedar and reconnect river to floodplain. The Rio Costilla watershed (Carson National Forest) restoration begun in 2007 continued in 2008. The project goal is to re-establish Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*), Rio Grande sucker (*Catostomus plebeius*), and Rio Grande chub (*Gila pandora*) to the watershed. The Canadian River fish community was monitored by ASIR and New Mexico Department of Game and Fish. Sampling provides status information for four protected species: sucker mouth minnow (*Phenacobius mirabilis*), southern redbelly dace (*Phoxinus erythrogaster*), Arkansas River speckled chub (*Macrhybopsis aestivalis tetranemus*), and Arkansas River shiner (*Notropis girardi*). In the Tularosa basin, yearly monitoring of White Sands pupfish continued into year thirteen, and the status of the fish is stable. The University of New Mexico, Department of Biology conducted genetic research on the Mimbres River fish community including the Rio Grande cutthroat trout, Rio Grande silvery minnow and Pecos bluntnose shiner.

Assessing habitat availability and use by endangered Colorado pikeminnow, *Ptychocheilus lucius*, and other native and non-native fish in the San Juan River, New Mexico-Utah

de la Hoz, Ernesto A. [1], Holden, Paul [1]. (1-BIO-WEST, Inc, Fisheries Section).

We investigated habitat availability and use by native and non-native fishes in two reaches along the San Juan River, New Mexico and Utah. Preliminary results of this on-going study are presented. Chi-squared selection ratios based on habitat availability and use data collected in summer of 2007 indicated that age-1 Colorado pikeminnow, (‚i>Ptychocheilus lucius), selected two habitat types, eddy and cobble shoal. In contrast, Chi-squared analyses suggested that the entire fish community, both natives and non-natives, selected against cobble shoal. Speckled dace, (‚i>Rhinichthys osculus), was the only species that also appeared to select eddy habitat. Our findings highlight the importance of cobble shoals for age-1 Colorado pikeminnow and that relatively few other fish species prefer this habitat type. Further, observed patterns of selection and selection against particular habitat types by native and non-native fishes provided evidence of the high overlap in habitat use. Both native and non-native fishes appeared to select isolated pool and pool habitat, while selecting against cobble shoal, run, and riffle habitats. Our results support findings from previous studies that have documented overlaps in resources used by native and non-native fishes in the San Juan River. Observed patterns of habitat selection and overlap highlight the potential for negative interspecific interactions (e.g., competition) between native and non-native fishes. While previous research has identified low water velocity habitat as important for small Colorado pikeminnow, this study allows the identification of specific habitat types with some current, such as cobble shoals and eddies, that are important for age-1 Colorado pikeminnow. Ongoing efforts aim towards the assessment of differences in habitat use by age-0 and age-1 pikeminnow, and differences in habitat use during different times of the year (i.e., spring, summer). As others have suggested, understanding which habitats are needed by each life stage in this highly modified system has important implications for the management and conservation of Colorado pikeminnow.

Test of a novel eradication method for a population of an invasive fish in a spring system in the Chihuahuan desert

Dugan, Laura E. [1]. (1-University of Texas, Section of Integrative Biology).

Invasive species are the second greatest threat to global biodiversity. Potential impacts from invasive species range from such ecological effects as competition with and predation of native species to genetic effects such as hybridization and outbreeding depression. They can also potentially bring novel diseases with them which can spread to native hosts. While the best method for dealing with an invasive species is prevention, this is often not possible. Amelioration methods that have been commonly used to manage invasive populations include physical removal, which is often time-consuming and labor intensive, and chemical removal and biocontrol, both of which may have major deleterious effects on non-target species. Eradication is often not a possibility when invasive populations have grown too large or cover too great an area, but is sometimes possible when the invasive population is discovered early before it has spread, in smaller populations, or for populations in more isolated geographic areas. A recent theory, coined the Trojan Y-chromosome theory of eradication (Gutierrez and Teem, 2006, J. Theor. Biol. 241: 333-341), states that for a population of an invasive fish species, the repeated introduction of feminized super-males (individuals with two YY chromosomes that have been feminized with diethylstilbestrol) over a period of time will cause the sex ratio to become so skewed towards males that there will not be a sufficient proportion of females to sustain the population, and thus the population will crash. This research explores the feasibility of application of this theory on a real system, the invasive West African jewel cichlid, *Hemichromis guttatus*, in the Cuatro Ciénegas valley in the Chihuahuan desert in Coahuila, México. It is hypothesized that this fish competes with the endemic Cuatro Ciénegas cichlid, *Herichthys minckleyi*, upon which it is hypothesized to have a negative impact. Whether this method is usable for a particular species depends upon the sex-determining mechanism of the invasive fish. Microarray analysis and amplified fragment length polymorphism (AFLP) methods are being employed to determine if *Hemichromis* has the appropriate sex-determination mechanism for application of this theoretical eradication method.

Conservation and management of the Quitobaquito pupfish, *Cyprinodon eremus*, in Sonora and Arizona

Duncan, Doug [1], Tibbitts, Tim [2]. (1-U.S.Fish and Wildlife Service, 2-National Park Service).

The Quitobaquito pupfish (*Cyprinodon eremus*), an endangered species, is extremely rare and threatened. Formerly considered a subspecies of the endangered desert pupfish, it occurs at only two sites in the wild; a half-acre pond at Quitobaquito Springs on Organ Pipe Cactus National Monument in Arizona, and just across the border in a one kilometer-long reach of the Río Sonoyta, in northern Sonora. The risk of extinction for the Quitobaquito pupfish is very high because of its limited distribution. Excessive groundwater pumping in a dry year combined with predation from nonnative fish species could easily eliminate the Río Sonoyta populations of Quitobaquito pupfish and longfin dace. Drying and possible contamination of Quitobaquito Springs threaten the Quitobaquito population of pupfish. In 2004 and 2005, refuge ponds were established at the visitor's centers for Cabeza Prieta National Wildlife Refuge and Organ Pipe Cactus National Monument and were stocked with pupfish from Quitobaquito. In spring and summer 2007, two refuge ponds were established and stocked with Quitobaquito pupfish and longfin dace from the Río Sonoyta. One is located at the Pinacate y Gran Desierto de Altar Biosphere Reserve headquarters and one at the Intercultural Center for the Study of Deserts and Oceans in Puerto Peñasco. Additionally, in summer 2007, we collected pupfish and dace from portions of the Río Sonoyta that were drying due to drought conditions and released them in the spring system at the Quitovac Indigenous Community. We built another pond in 2008, in the town of Sonoyta, at the high school. These ponds not only help us meet recovery tasks identified in the desert pupfish recovery plan, but will also be used as tools to educate the public about the importance of conserving our rare desert resources (educational panels will be displayed adjacent to the ponds). In 2006 through 2008, Quitobaquito Pond experienced acute reductions in water. Causes are suspected to include long-term drought and leaks in the retaining berm caused by tree roots. Monument staff increased routine maintenance, renovated the northeast spring, reinforced the retaining berm, and hauled supplemental water to the pond. Over 2000 pupfish have been temporarily evacuated, to monument headquarters, Cabeza Prieta, and the Arizona-Sonora Desert Museum. This project has been a joint effort of multiple partners, including: U.S. Fish and Wildlife Service, Pinacate and Gran Desierto de Altar Biosphere Reserve, Commission of Ecology and Sustainable Development of Sonora, CEDO, Quitovac Indigenous Community, University of Arizona, University of Arizona Cooperative Extension, Arizona Game and Fish Department, Caldwell Design, Organ Pipe Cactus National Monument, Cabeza Prieta National Wildlife Refuge, International Sonoran Desert Alliance, the Arizona-Sonora Desert Museum, and students from the Oregon State University Fish and Wildlife Club and Ajo Middle School.

Management of Cuatrociéngas Natural Protected Area in Coahuila, Mexico: The role of science and research needs

Garcia, Ivo [1], Ibarra, Juan [1], Carrera, Julio [1]. (1-Comision Nacional De Areas Naturales Protegidas).

Most natural protected areas in Mexico are administered by a federal commission for protected areas (CONANP), a decentralized body of the Ministry of Environment and Natural Resources (SEMARNAT). The goal of CONANP is to preserve the natural heritage of Mexico and to maintain ecological processes on natural protected areas (NPAs). Differently from other countries, the land within NPAs in Mexico is privately owned. Human activities conducted in NPAs by land owners are regulated by CONANP according to a master plan specific to the area. Under this system, NPAs are challenged to protect natural resources that are impacted by a wide range of human activities. Therefore, one of the major tenets of management of NPAs in Mexico is to identify critical threats and focus actions into managing those threats. CONANP has identified a great diversity of threats at Cuatrocienegas from illegal exploitation of resources and unregulated scientific activities, to poor land management practices and unregulated tourism and outdoor activities. Basic ecological research conducted at Cuatrocienegas and in particular on aquatic systems played a crucial role in establishing the protected area. However, applied research that can be translated into better land management practices and help CONANP in managing the protected area has been limited. Recently, the protected area identified the specific need of applied research on invasive species and on identifying indicators to monitor the health of ecosystems. CONANP is interested in collaborating and facilitating applied ecological research that can help in managing threats, make sound management decisions, and implementing conservation activities on NPAs.

Desert fishes research and management in Texas during 2008

Garrett, Gary [1], Allan, Nathan [2], Edwards, Robert [3]. (1-HoH Fisheries Science Center, Texas Parks & Wildlife, 2-U.S.Fish and Wildlife Service, Ecological Services, 3-University of Texas-Pan American, Department of Biology).

The critical habitat final rule for Devils River minnow, *Dionda diaboli*, was published on 12 August 2008. It will only apply to a portion of the range (San Felipe and Pinto creeks) which will allow continued partnerships for conservation in the Devils River. A very rainy 2007 seems to have enhanced populations in the Devils River and Pinto Creek. The San Felipe Creek population continues to be detrimentally impacted by the introduced suckermouth catfish, *Hypostomus* sp. Reestablishment plans for Rio Grande silvery minnow, *Hybognathus amarus*, in the Big Bend region are under way with an initial stocking scheduled for late 2008-early 2009. The Big Bend gambusia, *Gambusia gaigei*, population is stable at present. The National Park Service is maintaining the refuge by clearing some of the cattails and providing enhanced habitat diversity. A new refuge pond with a different spring source is ready for stocking from the refuge population and all will be monitored twice per year. The Clear Creek gambusia, *Gambusia heterochir*, population seems stable and a plan to establish a captive population at Inks Dam National Fish Hatchery is being developed. Population status of Leon Springs pupfish, *Cyprinodon bovinus*, is stable. Habitat modification at Diamond Y Spring seems to be working and there are now more territorial male pupfish and less interference from *Gambusia*. A new ciénega is being planned for Comanche Springs pupfish, *Cyprinodon elegans*, at Balmorhea State Park and progress continues on the new ciénega at Fort Stockton.

History and management of the endemic *Ambrysus* of Ash Meadows, Nye County, Nevada

Goodchild, Shawn C. [1], Parker, Michael S. [2]. (1-U. S. Fish and Wildlife Service, Nevada Fish and Wildlife Office, 2-Southern Oregon University, Department of Biology).

Spring systems within the Amargosa Valley, southern Nevada, support one of the highest densities of endemic species in North America, with at least 27 endemic species occurring within the Ash Meadows National Wildlife Refuge. Habitat isolation created by the matrix of springs, desert upland, and sodic soils compartmentalized non-volant aquatic invertebrates, which influenced speciation. Two species of Naucoridae, *Ambrysus amargosus* and *Ambrysus relictus*, are restricted to a few very small, low-flow springs. Severely altered by anthropogenic activity, these springs were on the verge of losing their thermally-endemic species. To address this issue, investigations were completed to determine habitat suitability for these insects. These investigations informed management actions, which included addition of appropriate substrate and bank vegetation management. As a result, populations of naucorids have dramatically increased. Substrate additions and increased primary production resulted in two- to three-fold increases in *A. amargosus* densities, and densities of associated invertebrate populations, in restored channels within the Point of Rocks system. In contrast, *A. relictus* populations have either declined or remained stable in unmanipulated spring habitats in the Warm Springs system. There are numerous interacting factors that still present challenges for successful management of naucorid populations and the habitats that sustain them, but they are not insurmountable. These include effects of management for other endemic species such as *Assiminea*, potential effects of invasive invertebrates such as crayfish and Melanoides, continual presence of a Devils Hole pupfish (*Cyprinodon diabolis*) refuge, and ongoing need for habitat maintenance. Overall, management for these aquatic invertebrates has been successful, and one of the few documented programs to manage for aquatic insects.

Status and management of the relict leopard frog, *Rana onca* , in southern Nevada and northern Arizona

Haley, Ross D [1], Drake, Dana [2], Jaeger Dr., Jef [2], Sjoberg, Jon [3]. (1-National Park Service, Lake Mead NRA, 2-Public Lands Institute, Universtiy of Nevada Las Vegas, 3-Nevada Department of Wildlife).

First described by Cope in 1875 from a single specimen collected in the Virgin River basin of southwestern Utah, the relict leopard frog, *Rana onca*, was considered to be extinct for approximately 36 years until its rediscovery at several locations within the Lake Mead National Recreation Area (NRA), Nevada, in 1991. From 1991-1995 a total of seven populations were identified, six within Lake Mead NRA and one in Mohave County, Arizona. Of these seven, two were extirpated by 1998 and one more was apparently extirpated in 2007. The global population of this species was thought to number fewer than 1100 individuals in 2000 (Bradford et al., 2004, Southwestern Naturalist 49(2):218-228). Conservation efforts for this species are complicated by its historic distribution encompassing trans-boundary areas of three states, and multiple jurisdictional areas of federal management agencies. Coordinated conservation actions were initiated in 2001 with formation of the Relict Leopard Frog Conservation Team (RLFCT) and a comprehensive Conservation Agreement and Strategy (CAS) was completed in fall 2005. In accordance with the CAS, the RLFCT partners have successfully implemented captive breeding and head-start programs, established five additional populations in the wild, re-introduced frogs at one site of recent extirpation, conducted habitat improvement projects, completed critical life history research activities, and have developed a cooperative field monitoring program. Current efforts are focused on management of existing wild and experimental populations, and on developing additional viable populations near or within historic range.

Upper Colorado River Basin Area Report: A brief discussion of the past and future of the Green River sub-basin

Hedrick, Trina N. [1]. (1-Utah Division of Wildlife Resources).

The Colorado River basin was the last large, unexplored area of the western United States. Though numerous explorers throughout the 1800's attempted to navigate the Green River beginning at Green River, Wyoming, most were thwarted by its wildness. Until the late 1860's, no one had ever mapped where the Grand and Green rivers met; no one had braved the waters of these rivers or the river resulting from their confluence, the Colorado. Some early hunters/trappers and 49ers did make it through Red, Lodore, and Split Mountain canyons, only to change their minds based on advice from the Ute Indian Tribe that lived along the Uinta (Duchesne) River in northeastern Utah. Only John Wesley Powell and his expedition of 1869 braved the river from the transcontinental railroad in Wyoming through the Grand Canyon. From this expedition, the United States received its first detailed map of the Green River, the confluence of the Green and Grand rivers, and the path of the Colorado River as it flowed into the Arizona Territory. We also received a very wise notion from Powell based on observations from his numerous trips to the West that this area could not be settled as the eastern United States had been. Unlimited development could not be a reality due to water limitations; agricultural lands would always need irrigation water to be productive. And while many people respected and admired Powell after his Colorado River expeditions, this advice went essentially unheeded by a nation more interested in Manifest Destiny. Even before Powell's expedition, water development within the Green River sub basin had already begun. Development of the tributaries continues today, mainly for municipal and agricultural uses, but increasingly for industrial uses as well. As we look to the future, two prospects weigh heavily on the river, the lifeblood of this region: the fact that not all of the Upper Colorado River Basin states currently receive their full allotment of Colorado River water and the potential for oil shale extraction, a water-intensive industry, to become viable. The Upper Colorado River Basin is unique in numerous ways and much of what makes it so unique is tied to the water within its rivers. A greater understanding of the history of this region may help us to understand and prepare for its future.

History of Cuatrociénegas' aquatic habitats with reflections on current conditions and restoration potential

Hendrickson, Dean A. [1]. (1-University of Texas, Texas Natural History Collection, Austin, Texas, USA).

Cuatrociénegas' long history of human impacts on wetlands will be reviewed and the broad scale measures required to sustain the natural aquatic ecosystems and a prosperous human community will be discussed. Surface waters have been massively reduced since the first canals were constructed over 100 years ago, and the valley is now further threatened by invasive species and increasing tourism. Much remains to be learned about hydrology of the region, but it appears that in many cases impacts of past manipulations are slow to be expressed as they propagate downstream over decades. The temporal scale of changes is enough that the sliding baseline phenomenon has resulted in ignorance among many stakeholders regarding what the area used to be like. If current trends continue, extinctions of endemic fauna will be witnessed in the not too distant future, and the human economy will continue to decline, forcing emigration of a large segment of the population. Declaration of the area as a protected area 14 years ago, while certainly appropriate, has had little beneficial impact on turning the tide that slowly started going out with those first canals and has accelerated with rapidly increasing groundwater exploitation during the last decade. The issues that need to be addressed greatly transcend CONANP's geographic and legislated scope and authority. Sustainable solutions for both native fauna and flora and humans are in fact complementary, though neither the biota nor the human will be able to persist without compromises. Sustaining Cuatrociénegas as both a Protected Natural Area that truly protects its diverse and highly endemic biota, while at the same time sustaining a viable human economy, will require broad, inter-agency and community-wide binding and enforceable agreements, as well as substantial government investment over an extended time period. While data gaps persist, enough is known now to allow some meaningful steps in the right direction to be taken immediately, but immediate actions are socioeconomically not possible. Negotiating and finalizing agreements required to implement such actions will entail intensive, well coordinated, interdisciplinary research carried out in close collaboration with the local community. Such broad scale collaborations and discussions will require researchers and government agencies to establish trusting relationships among themselves and with all stakeholders – a task that will be difficult at best given current levels of animosity among many stakeholders. Invariably sustainable solutions will require some stakeholders to make difficult compromises, and legal actions by some government agencies will also probably be unavoidable to force others, yet a sustainable and prosperous future for Cuatrociénegas' fauna (human and other) and flora is

attainable.

Impacts of mosquitofish, *Gambusia affinis*, on endangered Mohave tui chub, *Siphateles bicolor mohavensis*, growth and population dynamics: A mesocosm study approach

Henkanaththegedara, Sujan M. [1], Stockwell, Craig A. [1]. (1-North Dakota State University, Biological Sciences).

In the western United States, many native fish species have been negatively impacted by the introduction of mosquitofish, *Gambusia sp.*, however some species have co-existed with non-native mosquitofish for many decades. Such in the case with the Mohave tui chub, *Siphateles bicolor mohavensis* (Cyprinidae), a state and federally protected fish species that co-occurs with mosquitofish in two of its four habitats in California. We conducted a controlled mesocosm experiment to evaluate possible impacts of mosquitofish on Mohave tui chub (Lake Tuendae population) growth and population dynamics. We stocked mesocosms with 8 Mohave tui chubs (TL=80-120mm) and 75 mosquitofish (25 males and 50 females) and monitored the growth rates of tui chubs and population dynamics of two species over a 4-month period. Although the experiment yielded comparatively high numbers of Mohave tui chub larvae at the end of the experiment, there is no significant difference of number of chub larvae produced between control and treatments ($t=0.566$; $P>0.05$). However, there was relatively low survival and recruitment of mosquitofish in the mesocosms ($F=1766.04$; $P0.05$). Mean instantaneous growth rate of individual chubs (g/year) was significantly higher in the presence of mosquitofish compared to the control ($t=-1.7998$; $P<0.05$); contrary to the expectations. These results suggest Mohave tui chub may impact non-native populations of mosquitofish which in turn may allow co-occurrence of these two species.

Understanding the complex life history of a lacustrine sucker for conservation and management

Hines, Brian A. [1], Crowl, Todd A. [2]. (1-Utah State University, Department of Watershed Sciences, 2-Utah State University, Ecology Center and Department of Watershed Sciences).

The federally endangered June sucker, *Chasmistes liorus*, is a planktivorous sucker endemic to Utah Lake, Utah. They are known only to spawn in the Provo River (the largest tributary to Utah Lake), but data collected during the summer of 2008 revealed that *C. liorus* were present at the mouths of other smaller tributaries during the pre-spawning period. Due to the diminished population and the complexity of the system, little is known about their life history outside of the Provo River. Understanding life history characteristics is a key component to this species' recovery. Through a suite of methods including trap netting, trammel netting, light trapping, drift netting and stationary Passive Integrated Transponder (PIT) tag antennae, spawning adult and larval *C. liorus* were documented in several of the smaller tributaries to Utah Lake. Results from this study suggest that stream rehabilitation of the smaller tributaries could increase the amount of spawning habitat for *C. liorus* and potentially increase natural recruitment. The knowledge gained from this study will enhance our understanding of the *C. liorus*' life history and help in the recovery of this endangered species.

Ecomorphological relations between *Cottus* species and their environment in northeastern Utah

Hoagstrom, Christopher [1], Holmes, Nathan [1]. (1-Weber State University, Department of Zoology).

Factors inducing phenotypic plasticity of fishes are poorly understood. A recent study in middle North America revealed a relation between sculpin (*Cottus*) morphology and stream bottom velocity. We investigated this relation in 16 streams of northeastern Utah, but included 16 additional environmental variables, representing three spatial scales (mesohabitat, stream reach, watershed). We took 21 morphometric and two meristic measurements on all sculpin over 71 mm standard length, measuring a total of 373 individuals from 12 streams and 36 mesohabitats. Fifty-eight of these were mottled sculpin (*Cottus bairdii*) and 315 were Paiute sculpin (*Cottus beldingii*). Sculpin morphology varied substantially. One principle component (PC; explaining 29% of variation) revealed disparity in robustness, mouth size, and number of prickles among individuals and between species. Mottled sculpin were more robust with a larger mouth and more prickles. Another PC (explaining 11% of variation) revealed disparity in fin length, fin height, and head width among individuals but not between species. Environmental variables significantly explained morphological variation suggesting substantial phenotypic plasticity. Variation associated with the first PC was partly explained ($r^2 = 0.64$) by brown trout (*Salmo trutta*) abundance, fish species richness, mottled sculpin abundance, and stream bottom velocity. Variation associated with the second PC was partly explained ($r^2 = 0.41$) by Paiute sculpin abundance, mottled sculpin abundance, watershed area, brown trout abundance, water depth, stream bottom velocity, and substrate type. Overall, our results support the earlier study because stream bottom velocity influenced morphology. However, inclusion of additional variables substantially improved the explanatory model. In particular, biotic interactions (competition, predation) were important. Notably, nonnative brown trout were a substantial influence on sculpin morphology.

Contrasting demographic and genetic estimates of dispersal in the endangered Coahuilan box turtle

Howeth, Jennifer [1], McGaugh, Suzanne [2], Hendrickson, Dean [3]. (1-Section of Integrative Biology, University of Texas, Austin, 2-Department of Ecology, Evolution, and Organismal Biology, Iowa State University, Ames, 3-Section of Integrative Biology & Texas Natural Science Center, University of Texas, Austin).

The evolutionary trajectory of an endangered species largely depends upon the level of gene flow among subpopulations and consequently the degree of habitat patch connectivity. A conservation approach that jointly acknowledges connectivity occurring over ecological and evolutionary time scales may provide novel insight into the maintenance of genetic diversity. Here, we take this joint approach in evaluating the endangered Coahuilan box turtle (*Terrapene coahuila*) endemic to the isolated wetlands in the desert of Cuatrociénegas, Coahuila, México. The desert-spring ecosystem of Cuatro Ciénegas provides a patch-matrix mosaic that restricts dispersal among wetland habitats. Moreover, aquatic habitat loss and fragmentation has altered the spatial distribution of habitat patches and further inhibited interpatch connectivity. We therefore predicted that *T. coahuila* would exhibit metapopulation structure and limited dispersal over small spatial scales. To test this hypothesis, we 1) evaluated the spatial extent and frequency of dispersal via mark-recapture at local (< 2km) and regional (2 – 20 km) spatial scales in two subpopulations and 2) assessed gene flow among 7 subpopulations by surveying genetic diversity at 9 microsatellite loci. The mark-recapture study reveals frequent inter-wetland dispersal at the local scale and at a rate suggestive of a single subpopulation. At the regional scale, dispersal was relatively less frequent; however, one subpopulation was seasonally migratory. The population genetic analysis reveals moderate to high levels of gene flow with no indication of inbreeding. While there are low levels of spatial genetic structuring (global FST = 0.01), there is isolation by distance. This relationship is driven by one subpopulation (Laguna Grande) relatively isolated from the others by a physical barrier to dispersal. The genetic signatures provide a fingerprint of historic population structure and, in the presence of recent habitat loss (< 50 years), may not accurately reflect current conditions or predict future patterns of gene flow or the trajectory of *T. coahuila*. Our assessment, by jointly acknowledging ecological processes that are immediately susceptible to anthropogenic disturbance, and microevolutionary processes that provide the buffering mechanism of adaptation to such disturbance, yields a robust framework on which to build conservation recommendations for this species and other regional taxa that likely share the same evolutionary history.

Effects of trammel nets on native Arizona fishes using cortisol as a stress index

Hunt, Teresa A. [1], Propper, Catherine R. [2], Gibb, Alice C. [2]. (1-Arizona Game and Fish Department, Northern Arizona University, 2-Northern Arizona University).

Sampling and handling fish is critical for surveying fish populations, but such sampling should have minimal impacts on those populations surveyed. Trammel nets are commonly used to sample fish; however, little is known about post-capture effects. We evaluated the impact of trammel net sampling on survival of razorback sucker,

Xyrauchen texanus, bonytail, Gila elegans, and roundtail chub, Gila robusta, at 15, 20 and 25°C using plasma cortisol concentrations as a potential indicator of stress. Fish between 139 and 388 mm in total length were obtained from both captive hatchery-stock and wild populations, quarantined for 2 weeks, and acclimated in two 18,000-L artificial tanks for 13 days. "Treatment" fish were entangled in a trammel net for two hours and "control" fish were captured with a seine net. After capture, all fish were weighed, measured and PIT tagged according to established field procedures. We extracted on average 0.37 mL (no more then 0.5 ml) of blood from the caudal vasculature from 56% of the total number of experimental fish. Fish were then placed in a 36,000-L recovery/holding tank and monitored for survivorship for 13 days. Although the species varied in the magnitude of their response (p

Conservation of aquatic and riparian systems: the need to evaluate alternative management strategies

Kodric-Brown, Astrid [1], Brown H, James [1]. (1-University of New Mexico, Biology Department).

A recurring theme in the management and restoration of aquatic and riparian habitats in the southwest is fencing, to exclude cattle and other large grazers. When present, these megaherbivores typically remove much of the surrounding vegetation. Removal of grazing and browsing mammals and continued exclusion by fencing typically results in extensive growth of riparian vegetation, reduction of open aquatic habitat, and decrease in biodiversity. Local extinctions of species or reduction in population sizes have repeatedly been documented for fish and amphibians, and likely hold for invertebrates as well. Small springs, streams, and seeps are especially vulnerable to the impacts of fencing, but large ones are also affected. Although there are numerous anecdotal accounts, there are few studies that quantify community structure before and after fencing and even fewer long-term studies of changes in vegetation and aquatic fauna after fencing. Here we stress the need for long-term experimental studies, which will provide background data to guide current management activities, such as fencing and megaherbivore exclusion, controlled burning, and mechanical and/or manual removal of vegetation.

Predator detection and learning ability in an endemic lake sucker

Kraft, Stephanie [1], Crowl, Todd [1]. (1-Utah State University, Ecology Center).

In 2007, the International Union for the Conservation of Nature (IUCN) reported that 39% of all fish species evaluated are threatened; the highest for any vertebrate group. Threats to fish populations include habitat destruction, alteration, pollution, overexploitation, and nonnative species. Nonnative fish can impact native fish fauna in many ways including competition, disease, hybridization, and predation. Predation is often cited as the largest effect of nonnative fish, possibly due to the inability of native fish to recognize the predation threat posed by nonnatives. Endemic fish may be particularly susceptible to the effects of nonnative predators due to their limited range and often limited evolutionary ties to predators. Many fish assess predation risk through chemical alarm cues, which are stored in skin cells and released when cells are ruptured. The alarm cue serves as a signal of immediate threat to conspecifics in the area. Many fish also possess the ability to detect this alarm cue in the odor of predators who have recently consumed conspecifics. This ability may allow native fish to learn to recognize the odor of nonnative predators and thus evade predation. We investigated this using the June sucker, *Chasmistes liorus* , an endemic lake sucker in Utah Lake, Utah. Of the thirteen fish species native to Utah Lake only the June and Utah sucker, *Catostomus ardens*, still reside in the lake. Several nonnative predatory fish, including Largemouth Bass, *Micropterus salmoides*, have been introduced. We found that while the June sucker did not innately recognize the odor of largemouth bass, they were able to detect chemical alarm cues in the odor of a bass fed June sucker. We also found that June sucker could learn to associate Largemouth Bass odor with predation threat, though this association was short lived.

Determining trophic interactions in a complex lake food web using a size-dependent analysis of stable isotopes and stomach contents

Landom, Kevin L. [1], Crowl, Todd A. [2]. (1-Utah State University, Department of Watershed Sciences, 2-Utah State University, Ecology Center and Department of Watershed Sciences).

The product of a series of successful nonnative fish introductions in Utah Lake, UT, is an incredibly complex and specious food web dominated by nonnative fishes. The establishment of nonnative fishes is partially responsible for the eradication of native minnow species, extreme reduction in native sucker populations, and degradation of habitat. Our goal was to construct an empirically-based food web model to determine which species pose the greatest threat to conservation of the Utah Lake aquatic ecosystem. We used stable isotopes in conjunction with seasonal quantification of stomach contents to determine ontogenetic trophic interactions within the complex nonnative food web. We identify three problematic species. White bass, *Morone chrysops*, are extremely abundant, become piscivorous as young-of-year, and are the primary predation threat to small native fishes. Although stomach contents provided little insight into the feeding relationships of fathead minnow, *Pimephales promelas*, the ä^{15}N signature places them near the top trophic level, warranting concern regarding their effect on larval fish and egg survival. Common carp, *Cyprinus carpio*, are a carbon sink within the food web. Young carp grow extremely fast, making them unavailable as prey for most piscivores. Adult carp are relatively long lived and withhold energy from the rest of the food web until death. Our results will be used to assist conservation biologists in evaluating the cost-benefit potential of various management strategies.

A comparative field study on mating behaviors of the largespring gambusia, *Gambusia geiseri*

Lewis, Richard [1], Kroll, Christopher [1], Hargrave, Chad [1], Martin, Rachel [1], Rosado, Samir [1], Shoemaker, Landis [1], West, Janalyn [1], Deaton, Raelynn [1]. (1-Sam Houston State University, Department of Biology).

The largespring gambusia, *Gambusia geiseri*, is a livebearing mosquitofish that lives in cool water springs throughout central and west Texas. This species was introduced across Texas for mosquito control about 80 years ago. After the introductions, several of the populations survived in clear water springs, and persist today. Because these populations have been isolated for a significant time, they provide an excellent opportunity for *in situ* studies on potential mechanisms of speciation, including morphological, genetic, behavioral, and/or life history divergence. Deaton et. al. (in prep) have shown that there is significant genetic differentiation across six of these spring populations based on several polymorphic microsatellite loci. These findings suggest that these populations also may show divergence in behavior, population dynamics and/or life history strategies. In this study, we investigated natural mating behaviors across three spring populations in Texas (Comal River, San Marcos River, and Anson Spring) in order to assess potential behavioral differences. We used a repeated measures ANOVA experimental design choosing three target groups of fishes within each habitat, observing them (snorkeling observations) every hour for 20 minutes from dawn until dusk. We asked the following questions: (1) are their significant differences in mating behavior across the populations; (2) what are the natural peak mating times for males; (3) are mating differences correlated with predation, environmental conditions, or variations in sex ratio and/or densities. Data currently are being analyzed across the three populations, and will be presented.

Megupsilon aporus and *Cyprinodon alvarezi*: Observations in the field and laboratory behavior of two cyprinodontid fishes extinct in the wild

Liu, Robert K. [1]. (1-Ornament Magazine).

The speciose and fast-evolving Cyprinodontids have been, and continue to be, the subject of much phylogenetic research and management concern. Many species are endangered, and between 1971 and 1997, 7 species of Mexican *Cyprinodon* and the monotypic genus *Megupsilon* were extirpated in their habitats, although some are being maintained in captivity. For most of these species now extinct in the wild, as well as many still extant in the wild, nothing or little is known about their biology, especially behavior. *Megupsilon* and *Cyprinoodon alvarezi,* both from El Potosí, exemplify this lack of behavioral data. Discovered between 1948 and 1961, described in 1972, and extinct in the wild sometime after 1994 but with stocks maintained in captivity, Miller and Walters (1972) mention two unique behaviors of *M. aporus*, but nothing more has appeared regarding their behavior. In 1968, while finishing my dissertation on the comparative behavior of *Cyprinodon*, for about 10 months I kept and occasionally studied the laboratory behavior of about 40 specimens of these two species, and in 1972 I spent a day observing them in their then extant habitat. I report on those studies here, noting that *Cyprinodon alvarezi* behaves much like others of the *C. eximius* complex, but male *M. aporus* show Opercular Rotation (OR) and Jaw Nudging (JN), two behavioral acts not reported for any other New World Cyprinodontids except *Floridichthys carpio*, in which males exhibit a form of JN. OR may be very similar to Lowering Branchiostegal Membrane (LB), seen in *Fundulus* and in 3 genera of Old World cyprinodontids. Interestingly, JN also occurs in *Fundulus, Adinia* and at least 2 genera of Old World cyprinodontids. These and other observations will be discussed in relation to cyprinodontid phylogeny.

Current status of the freshwater fishes of northern Coahuila, México

Lozano-Vilano, M. de Lourdes [1], Contreras-Balderas, Armando J. [2]. (1-Facultad de Biología, Laboratorio de Ictiología, Universidad Autónoma de Nuevo León, San Nicolás de los Garza, Nuevo León, México , 2-Facultad de Biología, Laboratorio de Ornitología, Universidad Autónoma de Nuevo León, San Nicolás de los Garza, Nuevo León, México).

We report on a study to ascertain the current status of freshwater fishes of the northern part of the state of Coahuila. Three field trips visited a total of 48 locations, from which 41 species in 26 genera and 13 families were reported. Thirteen of these are listed in the Norma Oficial Mexicana NOM-059-SEMARNAT-2001, eight as "Threatened", four as "In danger" and one as "Special Protection." These collections include range extensions for longnose gar (*Lepisosteus osseus*), Devils River minnow (*Dionda cf diaboli*), blacktail shiner (*Cyprinella venusta*), Mexican blindcat (*Prietella phreatophila*), Rio Grande darter (*Etheostoma grahami*), and bigscale logperch (*Percina macrolepida*). We report the first records of *Hybognathus* sp., *Heterandria cf. formosa*, and *Lucania* sp., and new exotic species for the area, including sailfin molly (*Poecilia latipinna*), giant killifish (*Fundulus grandis*) and smallmouth bass (*Micropterus dolomieu*).

Se realizó un estudio para conocer el estado actual de los peces dulceacuícolas de la región Norte del Estado de Coahuila. Se efectuaron tres salidas de campo con un total de 48 localidades visitadas, de las cuales se reportan 41 especies, repartidos en 26 géneros y 13 familias. Ee éstas especies 13 se encuentran dentro de la norma oficial Mexicana NOM059-SEMARNAT-2001, 8 como "Amenazada", 4 "En Peligro" y 1 como "Protección Especial." Se amplia la distribución de catán aguja (*Lepisosteus osseus*), Diablos Río minnow (*Dionda cf diaboli*), carpita colinegra (*Cyprinella venusta*), bagre ciego de Múzquiz (*Prietella phreatophila*), perca del Bravo (*Etheostoma grahami*) y perca escamosa (*Percina macrolepida*). Se reporta por primera vez a *Hybognathus* sp., *Heterandria cf. formosa*, y *Lucania* sp. y, como nuevos registros de exóticos en el área, topote velo negro (*Poecilia latipinna*), sardinilla gigante (*Fundulus grandis*) y pequeña boca (*Micropterus dolomieu*).

Fixing broken ecosystems: Conservation and restoration in Fossil Creek and Cuatro Cienegas

Marks, Jane [1], Dinger, Eric [1], Haden, Allen [1], O'neill, Matt [1], Pace, Cinnamon [1], Adams, Ken [1], Compson, Zacchaeus [1], Hendrickson, Dean [2]. (1-Northern Arizona University, Department of Biology, 2-University of Texas, Department of Biology).

Our research program integrates food web ecology with biological monitoring to quantify the relative magnitude of different threats to freshwater biodiversity and study the restoration potential of management actions. In Fossil Creek, Arizona we combined stable isotope studies of food web structure with fish surveys to show that native fish were more threatened by the presence of exotic bass and sunfish than the reduction of flow. We tested this result using a before after control impact design following the restoration of Fossil Creek where flow was restored as part of dam decommissioning and exotic fish were removed from a large section of the river. Native fish responses were consistent with predictions, showing a fifty fold increase in native fish with the return of flow and the removal of exotic fish relative to a three fold increase due to restoration of flow alone where exotics never invaded. Native fish did not increase with the restoration of flow where exotic fish remain. In Cuatro Cienegas, Mexico, we combined stable isotope studies with field surveys and competition experiments to test how exotic fish affect native cichlids. We found that the effects of the exotic fish, Hemichromis guttatus were most pronounced on juvenile cichlids but relatively minor on adult cichlids. In a second experiment we tested whether native cichlids are essential to the persistence of stromatolites, a unique life form found only in a few freshwater habitats worldwide. We found that the molluscivore morph of this polymorphic fish maintains the integrity of stromatolites via a trophic cascade where molluscivores control snail densities thereby releasing stromatolites from intense grazing pressure

Population genetics of Ash Meadows pupfish

Martin, Andrew [1]. (1-University of Colorado, Dept of Ecology and Evolutionary Biology).

Ash Meadows harbors a large number of pupfish (*Cyprinodon nevadensis*) distributed across multiple springs and their outflows. Using a battery of 10 polymorphic microsatellite loci and ND2 mitochondrial DNA sequences I inferred the present and historical connectivity among populations and estimated effective population size for populations based on collections spanning a decade. Several inferences from the molecular data are noteworthy. First, there is robust separation of the two subspecies *C. n. mionectes* and *C. n. pectoralis*; however, assignment tests suggest South Scruggs may provide a conduit for migration between the lower elevation springs harboring mionectes and the upper elevation springs supporting pectoralis. Second, there is clear evidence for strong differentiation among spring pools and that these pools export individuals to the outflow system and lower elevation marshes; nonetheless, there is evidence for distinct outflow and marsh gene pools. Third, there is some indication that springs without flumes that channelize water from the spring exhibit greater connectivity than those with flumes. Fourth, individuals springs harbor modest effective population sizes, yet the two subspecies are characterized by enormous amounts of genetic diversity, a situation best explained by the effects of moderate population structure determined by the geographic configuration of springs. Finally, there is evidence for recent migration between North Indian and School springs sometime between 1998 and 2007, perhaps as a consequence of flooding. Interestingly, it appears movement was upstream. These and other inferences gained from analysis of molecular variation will be discussed in the light of planned restoration efforts.

Female reproductive success in a fish with a coercive mating system (*Gambusia affinis*)

Martin, Rachel E. [1], Cureton II, James C. [1], Hargrave, Chad C [1], Deaton, P. Raelynn [1]. (1-Sam Houston State University).

The Western mosquitofish, *Gambusia affinis*, is known to force copulate with females and thus serves as a model organism for testing sexual selection in coercive mating systems. In this species, much is known about the males' role in mating; however, how much control females have over male mating success or her own reproductive fitness remains untested. We tested for correlations between male mating behaviors and female fitness, and whether females have behavioral control over their own

reproductive success. We also tested if more time spent with a male (30-min vs. 24-hrs) would lead to increased fecundity. Female receptive behaviors were correlated with both male unsuccessful and successful copulations, and female resistant behaviors were correlated with male unsuccessful copulations. There was no difference in female fecundity between two time treatments. Females were largely unreceptive to coercive males, as expected, and more receptive to less coercive males. Male reproductive success (measured as successful copulations) was not dependent on female behaviors; however, males harassed less than expected (in terms of unsuccessful copulation attempts) when females were receptive, suggesting that males obtained more successful copulations with receptive females. In addition, males harassed more than expected when females were unresponsive, and thus, not resistant. Results suggest that, although male coercive behaviors appear to be the most important factor predicting both male and female reproductive success, female mosquitofish do have some level of behavioral control over their own reproductive fitness.

Flood disturbance effects on desert aquatic invertebrates with varying life histories

McMullen, Laura E. [1], Lytle, David A. [1]. (1-Oregon State University, Department of Zoology).

Most desert rivers experience frequent disturbances in the form of floods and droughts. Dam operations often reduce the magnitude and frequency of these disturbance events, creating more stable flow conditions. Organisms adapted to life in desert rivers have adaptations that allow their populations to persist and even thrive despite large flow fluctuations, and the effect of practically eliminating these disturbances from the environment of native desert aquatic organisms is largely unknown. We studied the effect of three separate experimental flood releases (springs of 2006, 2007, and 2008) on aquatic invertebrate populations in the managed Bill Williams River, AZ, USA. In particular, we focused on three target desert aquatic invertebrate taxa that vary greatly in their life histories: the gray sand dragon, *Progomphus borealis*, a small mayfly, *Fallceon quilleri*, and ostracods. Effects of floods on particular aquatic species depends much on the details of their life histories. Gray sand dragon numbers were reduced immediately post floods, but numbers rebounded within weeks, indicating that larvae had been laterally displaced and recovered through rheotaxic crawling behaviors. Mayfly numbers were dramatically lowered post floods but quickly rebounded sometimes to higher levels than pre floods. This is attributed to their quick lifecycles of 7-11 days and year-round reproduction. Ostracod numbers were reduced post flood and continued to plummet in later weeks, indicating their susceptibility to flood events. These data are important to the design of environmental flow plans on desert rivers, and emphasize the importance of understanding baseline life history information about species' in order to determine the potential effects of disturbances on their populations.

Conservation of the aparique trout

Montes, Jose Luis [1], Zapata López, Jenny [1], Ramos Gómez, Mauro [2]. (1-Programa Desierto Chihuahuense, WWF Programa México, 2-Comisión Nacional de Áreas Naturales Protegidas - Dirección Regional Norte y Sierra Madre Occidental).

A 10-minute video documentary, targeted to local communities and visitors at the rio Conchos headwaters, was produced by WWF as an educational tool to inform local communities and visitors of the importance of the aparique trout and basic recommendations for conserving the species and its habitat. The video is based on the Conchos Trout Management Plan, developed by the "Truchas Mexicanas" group in collaboration with the Ejido Panalachi and the Sierra Tarahumara Forest Conservation Program implemented by WWF and USAID. The Management Plan outlines three main strategies for conservation and enhancement of Conchos trout: (1) those that must be addressed to prevent extinction of the species, (2) those actions needed to improve its status, and (3) those commitments that will ensure its future as a sustainable natural resource. The people of Panalachi agreed to exclude a stretch of stream for protection of the trout; restoration of aparique habitat where considered necessary was also agreed, as well as the suspension of any fishing or poisoning in the area. A participatory committee was created for the protection of natural resources with support from the Attorney for the Protection of the Environment (PROFEPA). . Other agencies continue to pool resources and funding towards the recuperation of the aparique trout and the social processes implied. The Chihuahua State Government has included these messages in their statewide news releases and weekly TV program; the National Commission for Protected Areas (CONANP) continues to consider the Conchos headwaters in their priority areas, providing funds to the ejido for habitat restoration projects; and the Secretary for Agriculture, Livestock and Fisheries (SAGARPA) is hosting 22 Conchos trout individuals at the Guachochi Aquaculture Center, for future reproductive stock.

Patterns of genetic diversity in a community of cyprinid fish in the Pecos river, New Mexico

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

Genetic diversity has long been recognized as an important parameter to measure in conservation biology. The level of genetic variation displayed by a species is determined by the interaction of several factors including mutation rate, effective population size, selection and evolutionary history. Contemporary population dynamics and life-history can affect patterns of diversity as well. In this study we collected molecular data from seven members of the Pecos river (New Mexico) cyprinid community including native and recently introduced taxa, to explore the effects of these factors on diversity. We examined predictions including (i) that recent immigrants should show evidence of having undergone founding events with only a fraction of genetic variants of the source population and, (ii) native species should have higher levels of diversity as they have had longer to accumulate mutations. Results obtained were contrary to expectations with lower diversity in native species including Pecos bluntnose shiner (*Notropis simus pecosensis*), Rio Grande shiner (*Notropis jemezanus*) and speckled chub (*Macrhybopsis aestavalis*) compared to recent immigrants including Plains minnow (*Hybognathus amarus*) and the Arkansas river shiner (*Notropis girardi*). The sand shiner (*Notropis stramineus*) shows patterns of diversity that align it with the recent immigrants even though it is considered native to the Pecos river. Deeper divergences among haplotypes for recent immigrant imply introductions from multiple source populations. Our results also suggest that the Pecos river supports two genetically distinct forms of red shiner (*Cyprinella lutrensis*).

Restoration of the California golden trout in the South Fork Kern River, Kern Plateau, Tulare County, California, 1965-2004, with reference to Golden Trout Creek

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

In 1873, renowned mountaineer and surveyor Clarence King (a member of the legendary Whitney/Brewer survey party) commented in his classic "Mountaineering in the Sierra Nevada" about the horrendous damage created on the Kern River Plateau through unrestricted livestock grazing upon the vast mountain meadows that provide the evolutionary habitat of the California golden trout, *Oncorhynchus mykiss aguabonita*, since designated by the California State Fish and Game Commission as the California State Fish and one of the most valuable recreational and biological assets on public lands within California. Recovery of this area was slow in coming, but planning began in 1959 under mandate of California Governor Pat Brown and supported by his counterparts within upper echelons of the USDA-Forest Service. Under the joint responsibilities of both state and federal agencies, grazing allotments were gradually reduced, and California Department of Fish and Game fishery biologists, teamed with Inyo National Forest counterparts, began a recovery program involving removal of a population of invading brown trout, *Salmo trutta*, an exotic species which seriously threatened continued existence and evolution of the California golden trout. During early days of the recovery effort, brown trout (through competition and predation) in certain areas outnumbered golden trout at a ratio of more than 100:1. Obviously, this situation could no longer be tolerated. Genetically uncontaminated golden trout were nearing extinction. The current recovery program was implemented in 1965 and, although largely completed, remains in progress to this day as geneticists sort out the various populations within the recovery area. This work, closely adhering to philosophies and principles of early Forest Service pioneers Gifford Pinchot, Bob Marshall, and Aldo Leopold, has been summarized in this paper, authored by Edwin P. (Phil) Pister, a retired California Department of Fish and Game fishery biologist who has directed the recovery effort since its inception in 1959 in close cooperation with Inyo National Forest personnel. The paper provides a 40-year history that will serve as a basis for resource management upon the Kern River Plateau far into the foreseeable future. The recovery work no doubt constitutes the most lengthy, and difficult, such program ever undertaken for a fish, freshwater or otherwise.

Fish fossils and stable isotopes as paleo-indicators of ichthyofauna composition and climatic change in Lake Malawi, Africa

Reinthal, Peter N [1], Cohen, Andrew [2], Dettman, David L. [2], McDonough, Lisa Brooke [3]. (1-University of Arizona, Department of Ecology and Evolutionary Biology, 2-University of Arizona, Department of Geosciences, 3-University of Arizona, School of Natural Resources).

Climate change is one of the most important issues confronting the long term survival of desert fishes throughout the world. Rarely do we see climate change addressed in the long-term planning or conservation of desert fishes. Two major approaches to analyzing climate change are models to predict future climate and using chemical and biological indicators to reconstruct past climate change. In contrast to aquatic invertebrate and algal fossils and terrestrial pollen, fish fossils have rarely been used in paleolimnological studies as indicators of limnologic or climate change, or faunal composition. Here we present first results of fish fossil analyses from Lake Malawi drill cores, covering the last 135ka. We have quantified fish fossil composition and abundance and measured stable carbon isotopic ratios in scales and organic fraction of bone and teeth. Fossils buccal teeth, pharyngeal teeth and mill, vertebrae and scales are found. These are identified from the fish families Cichlidae and Cyprinidae (*Engraulicypris sardella*) and demonstrate variation in abundance throughout the core. We report stable carbon isotopic ratios from numerous fish fossils throughout the core which show a range of ƒÔ13C from -8.59 to -27.51, similar to that found in the contemporary pelagic fish fauna. These fish fossil records from Lake Malawi provide a new methodology and framework for interpreting pelagic versus inshore fish faunas that would correspond to lake level fluctuations and the evolution of the Lake Malawi fish.

Effects of salinity on White Sands pupfish (*Cyprinodon tularosa*) reproduction and population size

Rogowski, David [1], Stockwell, Craig [2]. (1-Texas Tech University, Dept. Natural Resources Management, 2-North Dakota State University, Dept. Biological Sciences).

Pupfish (Cyprinodonts) are generally able to tolerate a wide variety of salinities and are one of the few fishes to have successfully exploited this niche. With habitat loss being the greatest threat to their existence, it is increasingly important to create refuges and artificial propagation techniques. While pupfish are euryhaline, optimum salinities for growth and reproduction may actual differ from salinities levels currently present in habitats where pupfish occur. Previous research has shown that the White Sands pupfish (Cyprinodon tularosa) should be managed as two separate evolutionary significant units (ESU), Salt Creek and Malpais Spring populations. We investigated pupfish reproduction and population size at low (3.3) and high salinity (25) representing salinity regimes in Malpais Spring and Salt Creek respectively. Replicate populations were monitored over the period of a reproductive season (128 days) in outdoor mesocosms. Both strains did better in the low salinity environment. However, only the Salt Creek strain in the low salinity treatment had significantly higher recruitment and population size. There was not a significant difference in recruitment, and population size among the other treatments (both high salinity treatments, and low salinity Mound Spring treatment).

Monitoring the status of the endangered Borax Lake chub, *Gila boraxobius*, in a geothermal lake in southeastern Oregon

Scheerer, Paul [1], Jacobs, Steve [1]. (1-Oregon Department of Fish and Wildlife).

Borax Lake chub, *Gila boraxobius*, is a small minnow that is endemic to a natural 4.1 hectare geothermally-heated alkaline lake perched ten meters above the desert floor in Oregon's Alvord basin. The Borax Lake chub was listed as endangered under the federal Endangered Species Act in 1982 due to threats of habitat alteration caused by geothermal energy development and alteration of the lake shore crust to provide irrigation to surrounding pasture lands. From 2005-2008, the Oregon Department of Fish and Wildlife developed survey protocols to monitor population abundance using mark-recapture protocols and snorkel index surveys. We found that snorkel surveys lacked sensitivity to detect all but major changes in population abundance. We found that we could obtain mark-recapture estimates of the Borax Lake chub with a relative precision of +14-20% while marking approximately eight percent of the population and handling approximately 20 percent of the population. With a precision of +14-20%, we have the ability to detect a 26-34% decline in abundance. We will compare these results to previous monitoring efforts that occurred in 1986-1997 when a significantly larger effort and proportion of the population was sampled. I will also discuss the substantial progress has been made in reducing threats to the habitat which have improved the conservation status of this species, the primary remaining threats, (increased recreation use, potential geothermal development, and nonnative species), and provide recommendations for future investigations and monitoring.

Oregon / Northern California Area Report, November 2007-2008

Scheerer, Paul [1], Mauer, Alan [2], Reid, Stewart [3], Hogen, Dave [4], Walters, Tim [1]. (1-Oregon Department of Fish and Wildlife, 2-U.S. Fish and Wildlife Service, 3-Western Fishes, 4-U.S. Forest Service).

The northwestern extreme of the desert region includes six endorheic drainage subbasins in Oregon and northeastern California (Fort Rock, Chewaucan, Goose, Warner, Catlow, and Alvord). This region supports remnant fish faunas that once inhabited extensive pluvial Pleistocene lakes. Oregon Department of Fish and Wildlife (ODFW) conducted distribution surveys and obtained population estimates for Interior redband trout, conducted population surveys and radio tracked spawning migrations for lake-dwelling Warner suckers, operated a upstream and downstream migrant traps for Warner suckers, Catostomus warnerensis, and redband trout, Oncorhynchus mykiss, in the Warner Basin, obtained a population estimate for Borax Lake chub, Gila boraxobius, in the Alvord Basin (see presentation by Scheerer), and treated a 13 mile section of upper McDermitt Creek to remove non-native rainbow, brook, and brown trout from Lahontan cutthroat trout habitat. The Bureau of Land Management (BLM), ODFW, and U.S. Fish and Wildlife Service (USFWS) designed a restoration project to expand habitat for Foskett speckled dace, Rhinichthys osculus ssp., at Dace Spring. Work will be conducted by the BLM crew with funding assistance from USFWS and will be completed in 2009 and fish will likely be introduced later in the year, or early 2010. USFWS completed a Five-Year Status Review for Hutton Springs Tui Chub, Siphateles bicolor ssp., in accordance with the Endangered Species Act. The review supports recommendations by the recovery working group to set up a long term agreement with the landowner to secure an easement to conserve Hutton tui chub and its habitat. The Natural Resources Conservation Service will contact the landowner regarding interest in enrolling the habitat in the Wetlands Reserve Program, under which the landowner could be reimbursed for a 30 year or permanent easement. ODFW re-discovered a second spring, referred to as 3/8-Mile Spring, which contains Hutton Tui chub (last documented 30 years ago). The USFWS also initiated Five-Year Status Reviews for Foskett Specked dace and Borax Lake chub. The U.S. Forest Service completed fish passage improvement projects and conducted Modoc Sucker snorkel surveys in the Goose Lake subbasin, completed a fish passage improvement project, a head-cut stabilization project, and a large wood restoration project in the Warner Lakes subbasin, and completed a stream bank restoration project in the Lake Abert (Chewaucan) subbasin. Stewart Reid, Western Fishes, developed survey protocols to monitor populations of Modoc sucker, Catostomus microps, and worked to remove nonnative fishes from its habitat in the Goose Lake subbasin. Stewart assisted the USFWS in completing a Five-Year Status Review of the Modoc Sucker which recognized the presence of the Goose Lake population in Oregon. Stewart was also involved in a redband trout genetics study of California and Goose Lake redband, designed in part to ascertain the potential uniqueness of the Goose Lake (Pit) redband trout.

The presence of a congeneric predicts life history and body shape variation in the livebearing fish, *Poeciliopsis baenschi*

Scott, Laura E. [1], Johnson, Jerarld B. [1]. (1-Brigham Young University, Department of Biology).

Morphological traits and life history strategies can both be affected by limited resources. Often, environmental factors such as the presence of predators or stream velocity are important determinants of fish body shape and life history. Yet, some of our most compelling examples of ecological factors that shape morphological and life history traits focus on the effects of competition. In this study, we examine variation in life history and morphology among populations of the livebearing fish *Poeciliopsis baenschi* from central-western Mexico. We take advantage of a natural experiment where *P. baenschi* co-occur with a close relative, P. turneri, but also exist in isolation in several river drainages. Using geometric morphometrics and quantifying life history traits for *P. baenschi* we found a significant divergence in sympatric populations compared to their allopatric counterparts for both traits. Sympatric females had wider, more robust bodies and invested less overall to reproduction than allopatric females. We explore the possibility that these differences are driven by competition between these two species. By comparing these traits simultaneously, our work examines the link between body shape evolution and life history divergence among natural populations of fishes.

Morphologic and genetic variation of *Astyanax mexicanus* in the Atlantic slope of Mexico

Sepulveda, Daniel A. [1], Espinosa, Hector [1], Garcia, Francisco [2]. (1-Instituto de Biologia, UNAM, 2-Centro de Investigaciones Biológicas del Noroeste).

The species complex belonging to the Astyanax genus, or Mexican Tetras, whose distribution in Mexico, is a group that has many taxonomic problems, despite this, several works, osteological, morphological and genetic recognize two complexes with distribution in central Mexico, a northern group assignable to *Astyanax mexicanus* and a southern group assignable to *Astyanax aeneus*. There is also a species for Yucatan, *A. altoir*. Along the literature on this genra, they are different populations of forms not assigned to a species, so much for there distribution in the north as the south. One of these not described forms that appears in the literature of the genus is that population who inhabits in Cuatro Cienegas. For the following study there was realized a genetic preliminary analysis using seven localities, one of them from the population of Cuatro Cienegas, the marker used was microsatellites, Results were obtained for two loci, Ast01, in which nine alleles was observed, with a heterozygosity observed of 0.981, and Ast09, that presented eight alleles, with a heterozygosity of 0.603. A preliminary analysis of these results allows us to infer that the population from Cuatro Cienegas has an evolutionary process different from the rest of the studied localities. As response to these preliminary results, one presents the study of the morphometry of the species applying the model of Truss Network, for the same localities of the genetic study.

Taxonomic and distributional ichthyofaunal study of selected areas in northwestern Zacatecas, Mexico.

Solis-Carlos, Fernando [1], Lozano-Vilano, Ma de Lourdes [2], García-Ramírez, Ma Elena [3]. (1-Universidad Autónoma de Nuevo León).

The state of Zacatecas is located in the coordinates 21° 03' 00" y 25° 08'00" N y 100° 48'00" y 104° 21'00" W. The most part from there territorial it is an arid zone and due to there physics, weather and topomorphic factors there ecosystems are vulnerable. The most important and more affected in the last years are aquatic ecosystem. Its annual precipitation is about 510 mm with two rain station in the summer and winter. Zacatecas have a few backgrounds about de aquatic fauna and about that we can highlight: Algansea monticola a new Cyprinid fish [Barbour y Contreras 1968, Proc. Biol. Soc. Wash. 81:101-108], Ichthyofauna of Basins Nazas, Aguanaval, Parras [Salas, 1971, Tesis, FCB, UANL. Méx. 1-101], Review of Cyprinid Algansea monticola [Barbour y Miller 1978, Misc. Pub. Mus. Zool., Univ. Mich. (155):1-69], and a few others. This project was made in the NW from the state and included three hydrographical basins: Aguanaval, Santiago and Atengo (Santiago), we made 36 collects in 30 localities, in a period of three years, we used Chinchorro 3 m, Agallera nets and Electrofishing like a system of sample. We find 22 species in 17 generous and 8 families, 10 for them are exotic like mesa silverside, *Mendía jordani*, green Sunfish, *Lepomis cyanellus*, warmouth, *Lepomis gulosus*, bluegill, *Lepomis macrochirus*, largemouth bass, *Micropterus salmoides*, blue tilapia, *Oreochromis aureus*, Mozambique tilapia, *Oreochromis mossambicus*, common carp, *Cyprinus carpio*, blotched gambusia, *Gambusia seniles*, Tex-Mex gambusia, *Gambusia speciosa*. In accord to NOM-059-ECOL-2001, 5 species are like threatened, Nazas sucker, *Catostomus nebuliferus*, gibbous shiner, *Cyprinella garmani*, Mexican darter, *Etheostoma pottsi*, blotched gambusia, *Gambusia seniles*, nazas chub, *Gila conspersa*, and one danger, the Tex-Mex gambusia, *Gambusia speciosa*, at the same time we worked in a Zoogeographic and ecological analysis. This work is to give a very important step forward in the knowledge of the aquatic fauna of Zacatecas, not just by the mere fact of knowing which species are in the state, if not because with this you can have notion of species that have disappeared, Which have been introduced, new registrations of its current distribution, and have been displaced either by other species or by the extreme conditions in which they have been subjected. This is expected to give even being aware that a state with vast and arid region with serious problems of environmental degradation and water scarcity, there is still a large amount of aquatic life, and aquifers in good condition, which is still in time to rescue.

El estado de Zacatecas se encuentra localizado entre las coordenadas 21° 03' 00"N y 25° 08'00"N y 100° 48'00" y 104° 21'00"O. La mayor parte de su territorio es zona árida y debido a sus factores físicos, climáticos y topomórficos sus ecosistemas son muy vulnerables. Dentro de los más importantes y que se han visto fuertemente afectados en los últimos años son los acuáticos. Su precipitación media anual es de 510 mm con dos épocas de lluvia, una en verano y otra en invierno. Zacatecas cuenta con muy pocos antecedentes en cuanto a la fauna íctica, y dentro de estos podemos destacar la descripción de una especie nueva de Cyprinido, Algansea monticola [Barbour y Contreras 1968, Proc. Biol. Soc. Wash. 81:101-108], Ictiofauna del complejo Nazas, Aguanaval, Parras [Salas, 1971, Tesis, FCB, UANL. Méx. 1-101], revisión del Cyprinido Algansea monticola [Barbour y Miller 1978, Misc. Pub. Mus. Zool., Univ. Mich. (155):1-69], entre otros. El presente proyecto se realizo en la zona NW del estado y abarcaron tres cuencas hidrográficas que son: el Aguanaval, el Santiago y Atengo (Santiago), se realizaron 36 colectas en 30 localidades, en un periodo de 3 años, se utilizaron redes tipo Chinchorro, Agalleras y Electropesca como métodos de colecta. Se obtuvo un total de 22 especies repartidas en 17 géneros y 8 familias, de las cuales 10 son exóticas, (el Charal, Menidía jordani, Pez Sol, Lepomis cyanellus, la Mojarra golosa, Lepomis gulosus, Mojarra oreja azul, Lepomis macrochirus, Lobina negra, Micropterus salmoides, Tilapia azul, Oreochromis aureus, Tilapia Mozambique, Oreochromis mossambicus, la Carpa común, Cyprinus carpio, Guayacón del Bravo, Gambusia senilis, Guayacón de Nuevo León, Gambusia speciosa]. De acuerdo a la NOM-059-ECOL-2001, 5 especies se encuentran como Amenazadas, el Matalote del Nazas, Catostomus nebuliferus, Carpita jorobada, Cyprinella garmani, Perca Mexicana, Etheostoma pottsi, Guayacón del Bravo, Gambusia senilis, Carpa Mayrán, Gila conspersa, y una en Peligro Guayacón de Nuevo León, Gambusia speciosa), igualmente se hace un análisis zoogeográfico y ecológico de las especies. Este trabajo viene a dar un avance muy importante en el conocimiento de la fauna acuática de Zacatecas, no solo por el simple hecho de saber que especies se encuentran en el estado, si no porque con esto, podemos tener noción de las especies que han desaparecido, que se han introducido, de nuevos registros, de su distribución actual, y como han sido desplazadas ya sea por otras especies o por las condiciones extremas a las que han sido sujetas. Con esto se espera dar conocimiento de que aún siendo un Estado con una basta región árida y con graves problemas de deterioro ambiental y escasez de agua, sigue existiendo gran cantidad de vida acuática, así como mantos acuíferos en buen estado, los cuales todavía se esta a tiempo de rescatar.

Lower Colorado River Area Report, November 2007-2008

Sponholtz, Pamela [1], Kegerries, Ron [2], Sjoberg, Jon [3], Paroz, Yvette [4], Blasius, Heidi [5], Robinson, Tony [6], Andersen, Matthew [7], Fitzpatrick, Lesley [1]. (1-U.S. Fish and Wildlife Service, 2-BIO-WEST, Inc., 3-Nevada Department of Wildlife, 4-New Mexico Department of Game and Fish, 5-Bureau of Land Management, 6-Arizona Game and Fish Department, 7-U.S. Geological Survey, Grand Canyon Research and Monitoring Center).

It was a productive year for projects implemented under the Central Arizona Project Funds Transfer Program (CAP) in the Lower Colorado River basin. Completion of the CAP revised biological opinion brought the fund to $550,000 annually, and extended the fund timeline from 25 to 30 years. Under this program, the Bubbling Ponds Native Fish Facility was successful at producing spikedace, (*Meda fulgida*) and loach minnow, (*Tiaroga cobitis*), in captivity and has been able to produce over 6,500 fish for various repatriation projects. Fossil Creek, renovated in 2005, was one of the highlights of 2008 and was stocked with spikedace, loach minnow, razorback sucker, (*Xyrauchen texanus*), longfin dace, (*Agosia chrysogaster*), and desert pupfish (*Cyprinodon m. macularius*). In the Verde River, GIS is being used to provide georeferenced databases as a foundation for the development of a watershed-scale management plan and will identify boundaries between native fish and nonnative fish management units to reduce conflicts. In Grand Canyon, an additional 299 small humpback chub (*Gila cypha*) were translocated above a series of falls in the Little Colorado River and the approximate population size of the Grand Canyon humpback chub population, as of 2006 (most recent date currently available) is 6,017 (95% CI 5,369–6,747). Nevada Department of Wildlife (NDOW) is continuing to see positive results from efforts to re-establish the Virgin spinedace (*Lepidomeda m. mollispinis*) population in upper Beaver Dam Wash, Nevada. Monitoring surveys in November 2007 and May 2008 indicate continued reproduction and successful recruitment and some expansion of Virgin spinedace into upstream habitats. The Lower Virgin River Recovery Implementation Team has implemented a pilot rotenone treatment in preparation for larger efforts designed to prevent the spread of blue tilapia (*Oreochromis aureus*), and eventually red shiner (*Cyprinella lutrensis*), to the upper Virgin River. BIO-WEST, Inc. sampled the Muddy River from the Overton Wildlife Management Area upstream to the newly erected Bureau of Land Management fish barrier to determine the distribution and abundance of native and nonnative fishes in this area. Sampling efforts resulted in the capture of 12 distinct fish species including two native species Virgin River chub (*Gila seminuda*), and speckled dace (*Rhinichthys osculus*). However, during the spring 2008 sampling event red shiners were captured further upstream than any other recorded findings. In Lake Mead, NDOW continues to rear razorback suckers at the Lake Mead Fish Hatchery cooperatively with US Bureau of Reclamation primarily using wild caught Lake Mead larvae. Arizona State University finished six years of work monitoring post-stocking fate of razorback sucker and bonytail (*Gila elegan*s) stockings. There was no measurable long-term survival for razorback sucker, and the first year's survival was estimated at about only 30%. Along the Lower Colorado River, stocking activities in 2008 included over 65,000 razorback sucker into Lake Mohave, and Davis Dam to Imperial Dam using fish that are reared at Willow Beach from wild caught larvae. Over 24, 000 bonytail were stocked into Davis Dam to Imperial Dam reach from fish that are produced by Dexter National Fish Hatchery and reared at Dexter, Willow Beach, and Achii Hanyo. The state of New Mexico entered the second year of angling for federally threatened Gila trout (*Oncorhynchus gilae*) and stocked excess hatchery trout for recreation in 2008. New Mexico Department of Game and Fish has been working with private landowners to benefit native fishes and has stocked roundtail chub (*Gila robusta*) into a Nature Conservancy pond and Gila topminnow (*Poeciliopsis o. occidentalis*) into Burro Cienega. University of Arizona is nearing completion on research aimed at methods to propagate 5 species of desert fishes and optimizing mechanical control techniques for invasive crayfish. In addition, they have begun to identify factors limiting survival of Devils Hole pupfish (*Cyprinodon diabolis*) larvae and research into the spawning ecology of Devils Hole pupfish. In the Little Colorado River drainage, the population levels of LC spinedace (*Lepidomeda vittata*) in Nutrioso and Rudd creeks continue to fluctuate due to drought and an abundance of non-native crayfish. However, multiple age classes were found, and some areas of the creeks had large populations. In East Clear Creek, adult and YOY LC spinedace were observed in Yeager Canyon which was stocked last year using broodstock raised at the Flagstaff arboretum. Unfortunately, green sunfish (*Lepomis cyanellus*), largemouth bass (*Micropterus salmoides*) and yellow bullhead (*Ameiurus natalis*) were captured in Blueridge reservoir. These are new species to this drainage and could decimate already low LC spinedace populations. Arizona Game and Fish Department and the U.S. Fish and Wildlife Service augmented the Mexican stoneroller (*Campostoma ornatum*) population in West Turkey Creek on the El Coronado Ranch and two new populations of Apache trout (*Oncorhynchus apache*) were established in the White Mountains. A multi-agency native fish enhancement project was completed in Bonita Creek and included the construction of a physical barrier to prevent upstream movement of nonnative fishes, chemical removal of nonnative fish from a 1.7 mile reach, and repatriation of currently extant native fishes Gila chub (*Gila intermedia*), longfin dace, speckled dace, Sonora sucker (*Catostomus insignis*), and desert sucker (*Pantosteus clarki*). Contributors to this report include (in alphabetical order): Matthew Andersen, Chuck Benedict, Heidi Blasius, Scott Bonar, Chris Cantrell, Stephanie Carman, Doug Duncan, Lesley Fitzpatrick, Ron Kegerries, Brian Kesner, Jason Kline, Anne Kretschmann, Yvette Paroz, Craig Paukert, Tony Robinson, John Sjoberg, Mitch Thorson, Jeremy Voeltz, David Ward

Consultation and collaboration: Balancing water resource management with conservation of the endangered Moapa dace, *Moapa coriacea*

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

The Moapa Warm Springs in southern Nevada, a regional spring complex that is the headwaters of the Muddy River, is primarily fed by the White River carbonate flow system. These springs and the 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. These include construction of fish barriers, removal of invasive species, riparian habitat restoration, and development of an ecological model for the Moapa dace. To facilitate recovery of the dace and other species, SNWA purchased the 1,218 acre Warm Springs Ranch in September 2007 and designated it the Warm Springs Natural Area. Evaluation of carbonate groundwater pumping in Coyote Spring Valley will be completed to determine the relationship to discharge rates in the Moapa Warm Springs area. The Nevada State Engineer required an aquifer test to evaluate the relationship between carbonate pumping in Coyote Spring Valley and the Moapa Warm Springs. SNWA applied for rights-of-way (ROW) with the Bureau of Land Management to construct water facilities and to conduct an aquifer test of the SNWA's existing water rights in Coyote Spring Valley. The pipeline will transport water to the Moapa Valley Water District's (MVWD) system. The ROW application triggered a Section 7 Consultation with the U.S. Fish and Wildlife Service (USFWS). Through this consultation, a memorandum of agreement between the Authority, USFWS, Coyote Spring Investment, MVWD and the Moapa Band of Paiutes was developed, and a monitoring and mitigation plan was agreed upon. This plan provides for continuous hydrological and biological monitoring, and aggressive conservation actions toward recovery of the Moapa dace. However, over the last year, Moapa dace numbers have declined to their lowest levels ever recorded. Working with the USFWS, Nevada Department of Wildlife (NDOW), and the US Geological Survey, SNWA is conducting stream restoration work and intensive habitat improvements to reverse the decline of fish numbers. Furthermore, the SNWA has developed a system to quantify current ecological conditions and to measure habitat restoration for the Moapa dace.

Conservation genetic status of Gila trout

Turner, Thomas F. [1], Peters, Maureen B. , Wilson, Wade D. . (1-University of New Mexico, Museum of Southwestern Biology).

Gila trout occur in semi-isolated populations in the Gila River basin of New Mexico and Arizona. This species has been actively managed for over four decades to prevent extinction from catastrophic events and hybridization from non-native trout species. Here, we present data from mitochondrial (mt) DNA, microsatellites, and non-neutral genetic markers (MHC class II) to evaluate relationships between extant lineages of Gila trout. Of these, Main Diamond and South Diamond lineages are most closely related, followed by Whiskey and the most distantly related Spruce Creek lineage. Phylogenetic analysis of mtDNA-ND4 indicated that Gila and Apache trout form monophyletic group with respect to rainbow trout and Mexican trout. Management actions have successfully maintained the genetic integrity of Gila trout lineages. We discuss the implications of a potential trade off in managing for genetic integrity versus management for genetic diversity within lineages. Future research will attempt to evaluate demographic and genetic connectedness of Gila trout introduced into the newly renovated West Fork of the Gila River in an attempt to make recommendations about maintenance of within-lineage diversity.

Phylogeographic patterns within the central Australian rainbowfishes

Unmack, Peter J [1], Adams, Mark [2], Dowling, Thomas E. [3]. (1-Brigham Young University, Department of Biology, 2-South Australian Museum, Evolutionary Biology Unit, 3-Arizona State University, School of Life Sciences).

Phylogenetic patterns within Australian desert fishes remain relatively poorly known, although considerable research is underway to investigate the systematics and biogeography of this unusual fauna. A phylogeographic study was recently completed on one of the more abundant groups, the rainbowfishes (Melanotaeniidae: *Melanotaenia*) as part of a broader Australia wide examination of the group. Two species occur in the eastern arid portion of Australia, *Melanotaenia fluviatilis* in the Murray-Darling Basin and *M. splendida tatei* which occurs in western portion of Murray-Darling Basin and the Lake Eyre Basin. We used SSCP to determine variation in a portion of the mitochondrial cytochrome b gene and allozyme electrophoresis on 18 variable loci to examine phylogeographic patterns. Results suggest that central Australian rainbowfishes have a complicated history, with several potential invasions into the Lake Eyre Basin from surrounding drainages. In addition, *M. s. tatei* appears to have recently invaded the Murray-Darling Basin and a hybrid zone now exists where they come into contact with *M. fluviatilis*. The history of *M. fluviatilis* is also complicated by introgression with *M. duboulayi*, a species found in eastern coastal drainages. This work adds to the growing body of evidence that hybridization and introgression in rainbowfishes may be more common than previously thought and has important implications at multiple temporal and spatial scales.

Preliminary report of a new platy, *Xiphophorus* sp., from near Monterrey, Nuevo León, México

Valdés-Gonzalez, Arcadio [1], Contreras-Balderas, Salvador [2], Angeles-Villeda, Maria elena [1]. (1-Lab de Acuacultura, Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León, , 2-Bioconservación, A. C. Apartado Postal 405 San Nicolás de los Garza, Nuevo León, México 66450).

For several years, hybrids of regionally native platies and the introduced *Xiphophorus variatus* have been reported near Monterrey, Nuevo León. Knowing those reports, we searched headwaters of local streams (which will soon disappear due to urban growth) and discovered an isolated population of an undescribed northern platy in the origin of the Arroyo Santa Ana, a tributary of the Arroyo Ebanal of the San Juan River system. Specimens have a slender body, a spotted or freckled color pattern (80% of specimens), and only occasionally show vertical bars. The new species is separated from other northern platies by having 10-12 gill rakers on the first arch (13-18 in closely related species) and, on average, two more and one less dorsal and anal fin rays, respectively. Lateral line and circumbody scale counts are both one less than in closely related species. The third gonopodial ray has 4 molariform/multicuspid hooks and 3 unicuspid hooks, while that of *X. couchianus* has 8 unicuspid hooks and ends in a small terminal hook. The fourth "a" gonopodial ray has fewer elements and ends in a pair of elongate, recurved elements. The fourth "p" ray ends with 6 elements of the ramus, followed by 4 undifferentiated elements with 8 forked spines supporting the "canoe" of the fifth ray. The latter has 3 undifferentiated elements with a reduced vestigial hook (usually absent in other platies). Additionally, the terminal portion of the caudal fin lacks or has a vestigial sword. Currently, we are making morphological comparisons with other platies (*X. couchianus, X. couchianus apodaca, X. variatus, X. xiphidium, X. gordoni, X. meyeri*) and are conducting molecular genetic work to fully characterize the species, with a view to formally naming it to reflect its status as the last local species to persist and so far tolerate introductions of exotics, habitat alterations, water resource abuses, and (soon) the "Cerro de la Silla tunnel" which will be constructed through the exact canyon and stream that harbors the new species.

En las cercanías de Monterrey por años se han conocido híbridos de los platis regionales con *Xiphophorus variatus*. Conociendo lo anterior buscamos en las cabeceras de los cuerpos de agua que pronto estarán por desaparecer por el crecimiento urbano y se ha localizado una población de peces indescritos del grupo de platis norteños en el origen del Arroyo de Santa Ana, afluente del Arroyo Ebanal del Río San Juan. Dichos peces presentan una estabilidad morfológica más esbelta, coloración moteada por "pecas" en el 80% de los ejemplares y barras verticales solo ocasionalmente. Se separa de las demás especies de platis norteños" por el número de branquiespinas del primer arco branquial 10-12, cuando en las especies cercanas es de 13-18. Por el conteo de los radios de la aleta dorsal y anal con uno a dos radios mas y uno menos en promedio. Presentan aproximadamente una escama menos en la línea lateral y alrededor del cuerpo, significando escamas más grandes relativamente. El numero de ganchillos del 3er radio gonopodial son 4 molariformes policuspides y 3 unicuspides mientras que en *X. couchianus* tienen 8 unicuspides, además forma un pequeño gancho terminal; el radio gonopodial 4°a contiene menor numero de elementos y termina en un par de artículos elongados retrorso, el 4°p termina en 6 elementos del ramus seguido por 4 indiferenciados y 8 espinas furcas para soportar la "canoa" del 5° radio con 3 elementos indiferenciados y un gancho reducido vestigial ausente en los demás platis. Además en la porción terminal cuenta con espada vestigial o ausente. Se esta haciendo la comparación con el grupo de platies *X. couchianus, X. "couchianus" apodaca, X. variatus, X. xiphidium, X. gordoni* and *X. meyeri* para su morfometría y los trabajos de genética molecular para obtener una clara distinción de esta especie que será llamada *X. regio* por ser la última especie para sobrevivir y aguantar todas las introducciones, alteraciones y uso abusivo del agua y ahora el "Túnel del Cerro de la Silla" que pronto se construirá justo sobre el Cañón y Arroyo que dio origen a esta especie.

Habitat of lowland leopard frogs in mountain canyons of southeastern Arizona

Wallace, J. Eric [1], Steidl, Robert J. [1], Swann, Don E. [2]. (1-University of Arizona, School of Natural Resources, 2-National Park Service, Saguaro National Park).

Freshwater ecosystems and the organisms that inhabit them are imperiled worldwide, especially in the arid southwestern U.S. where aquatic environments are limited and vulnerable to human disturbances. Two of the most imperiled vertebrate taxa in Arizona, fish and amphibians, have declined over much of their ranges and often remain only in relatively undisturbed, isolated, low-order streams. We assessed habitat characteristics associated with presence of lowland leopard frogs, *Rana yavapaiensis*, in mountain canyons of southeastern Arizona at landscape (canyon) and patch (pool) scales. We surveyed 25 canyons for presence of frogs and measured characteristics of 91 pools within 9 occupied canyons. Canyons that were inhabited by frogs versus those that were uninhabited had larger watersheds (14.3 ± 1.85 km^2 versus 6.4 ± 1.60 km^2, mean ± SE), wider stream channels (3.4 ± 0.36 m versus 2.0 ± 0.33 m), were closer to the nearest valley stream (2.0 ± 0.77 km versus 5.1 ± 0.67) and had larger perennial pools (61.6 ± 6.87 m^3 versus 23.1 ± 5.54 m^3). Plunge pools that were inhabited had an average of 13% more perimeter vegetation, 10% more canopy cover and 1.7 more refugia than uninhabited plunge pools. In tinajas, no measured characteristics reliably distinguished inhabited from uninhabited pools. Unless natural hydrological and watershed processes that ensure perennial surface waters in mountain canyons are maintained through appropriate management, populations of leopard frogs and other aquatic organisms inhabiting aquatic refugia in these arid mountain streams will continue to decline.

Could salt be used to control bullfrogs in small ponds?

Ward, David [1], Finch, Colton [2], Blasius, Heidi [3]. (1-Arizona Game and Fish, Research Branch, 2-University of Arizona, 3-Bureau of Land Management).

New techniques and tools are greatly needed for selective removal of invasive aquatic species. We examined survival of bullfrog, *Rana catesbeiana*, eggs and tadpoles at 3 parts per thousand (ppt) and 6 ppt salinity in the laboratory to determine if low-level salinity could be used to eradicate bullfrogs from small ponds containing native fish. Bullfrog eggs and newly hatched tadpoles experienced 100% mortality when held at 6 ppt salinity for 10 days. Bullfrog tadpoles 10-15 days old also experienced significantly reduced survival when exposed to salinity of 6 ppt for 10 days. Older bullfrog tadpoles (>9 months old) appeared unaffected by 14 days of 6 ppt salinity. Salinity of 3 ppt did not impact survival of bullfrog eggs or tadpoles at any of the life stages we tested. Adding salt to ponds in the early spring to increase salinity to 6 ppt may be a cost effective way to eradicate bullfrogs from small ponds without harming native fishes.

Bonneville Basin Area Report

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

I present a brief summary of activities for this year associated with native aquatic species in the Bonneville Basin. Least chub, *Iotichthys phlegethontis*, has been reintroduced into several new refuge and range expansion locations. Nine thousand least chub were reintroduced to five locations in Box Elder and Cache counties. Utah Division Wildlife Resources is working with the local County Mosquito Abatement District to test the effectiveness of using least chub in mosquito abatement programs. The Mosquito Abatement District is conducting a pilot study testing effectiveness of least chub compared to western mosquitofish, *Gambusia affinis* in controlling mosquitos. If least chub are effective at reducing mosquito larvae, least chub could replace western mosquitofish in mosquito abatement programs in the Bonneville Basin. The June Sucker, *Chasmistes liorus*, Recovery Program continues to be very active. Approximately 68,000 (200 mm TL) June sucker were reintroduced into Utah Lake as part of recovery efforts. June sucker are propagated from brood stock held at Utah Division of Wildlife Resources hatchery facility at the Fisheries Experiment Station (FES), Logan, Utah. Thirty-seven thousand were reared at FES and the remaining 31,000 were reared in grow out ponds. Utah, Wyoming, and Idaho form the rangewide team for the northern leatherside chub, *Lepidomeda copei*. The team plans to expand the Conservation Strategy for northern leathersides to a Conservation Agreement and Strategy (CAS). The Nevada Department of Wildlife has been contacted to join the northern leatherside team because recent surveys have documented northern leatherside chub in northeast Nevada. The CAS for northern leatherside chub will be finalized and signed by all signatory agencies soon. The southern leatherside chub, *Lepidomeda aliciae* will also have its own CAS supported by signatory agencies solely in Utah and soon finalized.

Taking the long view: lacustrine, fluvial, and marine-type stromatolites of the Cuatro Ciénegas Basin with fundamentally different methods of formation and preservation potential

Winsborough, Barbara M. [1]. (1-Winsborough Consulting).

One of the unique and remarkable aspects of the lakes and streams in the Cuatro Ciénegas basin is the simultaneous growth of five different kinds of stromatolites, including one type formed primarily by the trapping and binding of carbonate grains, with secondary cementation, in the manner typical of marine stromatolites. Features common to all of these different kinds stromatolites are that they are lithified, laminated, organo-sedimentary structures built by microbial communities. Differences among the various types can be ascribed to velocity and directionality of water current, water level consistency, substrate availability, water chemistry and depth. Characteristics that vary among the different forms are morphology, size, growth rate, microbial mat thickness, principal photosynthetic organisms, impacts of fish and invertebrate grazers, type of lamination, degree of cementation, fragility and preservation potential.

Status and conservation of native catostomids in the Lower Pecos River, New Mexico

Zymonas, Nikolas D. [1], Propst, David L. [1]. (1-New Mexico Department of Game and Fish).

The native fish assemblage of the lower Pecos River drainage in New Mexico historically included four catostomids: river carpsucker *Carpiodes carpio*, blue sucker *Cycleptus elongatus*, smallmouth buffalo *Ictiobus bubalus*, and gray redhorse *Moxostoma congestum*. The lower Pecos constitutes the entire range of blue sucker and gray redhorse in New Mexico. All four species were common in various surveys prior to 2000, particularly from Malaga, NM upstream. More intensive investigations since 2000 have documented a dramatic decline of native fishes in this reach beginning in 2003 in association with toxic outbreaks of golden algae *Prymnesium parvum*. Blue sucker populations have been extirpated from the main stem Pecos River. A small population exists in the Black River, one of only two perennial tributaries to the lower Pecos in NM, although recruitment has not been documented. Gray redhorse is common in the Black River, but in the Pecos River persists only in a 10-km fragment below Carlsbad and near the confluence of the Black River. Recurring outbreaks of golden algae (e.g., October and November 2007) threaten remaining populations in the Pecos River. Smallmouth buffalo have not been collected in the Pecos since 2003. River carpsucker remains common in the lower Pecos River and upstream as well. In response to species declines, a golden algae monitoring program was started, and ways to lessen the likelihood and severity of toxic outbreaks are being explored. Captive propagation programs have been started for blue sucker and gray redhorse, and a formal State of New Mexico recovery planning process is underway.

Poster Presentation Abstracts (in alphabetical order)

Phylogeography, geometric morphometrics, and life history variation of the knife livebearer, *Alfaro cultratus* (Cyprinodontiformes: Poeciliidae) from Costa Rica

Bagley, Justin C. [1], Brummer, Tessa [1], Nay, Lacey [1], Johnson, Jerald B. [1]. (1-Brigham Young University, Department of Biology).

Alfaro cultratus is a small, livebearing fish endemic to the Atlantic versant of Lower MesoAmerica (LMA) from the Río Prinzapolka, Nicaragua, to the Río Cricamola in western Panama. *A. cultratus* represents an important, yet untargeted focal species for ecological and evolutionary studies because its distribution spans >20 major hydrological basins and three major LMA biogeographical fish provinces (Usumacinta, San Juan, Bocas). Given the hypotheses (i) that LMA fishes colonized the area during recent times following the Pliocene completion of the Isthmus of Panama, (ii) drainage basins limit dispersal of primary and secondary LMA freshwater fishes, and (iii) that a regional basis for relationships among LMA fish faunas suggests similar processes have shaped patterns of species with similar distributions, we predict inferring ecological and genetic signatures of colonization events will be possible. Also, some natural populations of *A. cultratus* contain predatory fishes, while others historically do not. These aspects of biogeographical and ecological heterogeneity within the species' range suggest potential genetic breaks (between provinces and drainages) and environmental associations (e.g., of predator regimes) with (physical, ecological) constraints on and trade-offs in phenotypic life history variation (e.g., female body size vs. offspring size and number). We present analyses of mitochondrial DNA (cytochrome b gene) phylogeography, body shape differences, and life history variation among *A. cultratus* throughout its range in Costa Rica. Our analyses not only test multiple biogeographical and evolutionary hypotheses, which will be discussed, but also serve as baseline information for future inquiry into these facets of biological variation within this unique species.

Effects of global climate change on Devils Hole and the Devils Hole pupfish *Cyprinodon diabolis*

Barrett, Paul J [1], Deacon, James E [2]. (1-US Fish and Wildlife Service, 2-University of Nevada, Las Vegas).

Devils Hole, Nye County, Nevada, was designated as a disjunct portion of Death Valley National Monument (now Park) in 1952 by President Harry Truman 'for the preservation of the unusual features of scenic, scientific, and educational interest therein contained.' The consensus of 19 models of global climate change examined by Seagar (2007) predicts a warming and drying trend in the desert southwest. This can impact Devils Hole and the endemic pupfish through increased water temperatures and consequently decreased pupfish for both oogenisis and adult metabolic activities. Furthermore increased anthropogenic uses of groundwater from the aquifer supporting Devils Hole will likely result in a lowering of the water level in Devils Hole with consequent biological, legal, and policy implications.

Microsatellite primer development for the largespring gambusia, *Gambusia geiseri*

Cureton II, James C. [1], Buchman, Anna B. [2], Randle, Chris P. [3], Deaton, Raelynn [4]. (1-Sam Houston State University, Department of Biological Sciences).

The largespring gambusia, *Gambusia geiseri*, is a livebearing, spring-dwelling fish of the family Poeciliidae that is habitat sensitive and survives only in large, cool springs. In an attempt to reduce the mosquito populations many years ago, *G. geiseri* was mistakenly introduced into several rivers and springs all across Texas, resulting in several isolated populations. Deaton et al. (in prep) have shown significant genetic divergence at seven microsatellite loci across six populations of G. geiseri throughout Central and West Texas. However, they used microsatellite primers developed for *G. affinis*, which are not highly compatible with *G. geiseri*. Microsatellite primers are commonly developed and used to investigate multiple paternity questions as well as hybridization, genetic variation, and divergence across populations. Because they evolve quickly and have high polymorphism, they are desirable in genetic analyses. The purpose of this study is to develop microsatellite primers for *G. geiseri* that will be used to assess genetic variation and differentiation within and among several isolated populations of *G. geiseri*, to investigate multiple paternity across isolated populations, and to make primers specific to *G. geiseri* available to other researchers who are studying some aspect of *G. geiseri* biology. At this time, five primers have been optimized and are currently being tested on the San Marcos population of *G. geiseri*. Here, we will provide initial, basic analyses of current microsatellites in process of development, including the number of alleles, linkage disequilibrium among loci, observed & expected heterozygosity, and the inbreeding level.

Comparison of bones with taxonomic value using geometric morphometrics for the identification of, *Siphateles bicolor*, subspecies from the Owens River basin

Galicia, David [1], Parmenter, Steve [2], Leunda, Pedro M. [3], Madoz, Javier [4], Miranda, Rafael [1]. (1-University of Navarra, Department of Zoology & Ecology, 2-California Department of Fish and Game, Eastern Sierra Inland Deserts Region, 3-GAVRN, S.A., 4-Flumen estudios y proyectos ambientales, S.L.).

The endangered Owens tui chub, *Siphateles bicolor snyderi*, was described by RR Miller in 1973 as endemic to the Owens River basin of eastern California, distinguishing it from other subspecies of *S. bicolor* by morphological characteristics of the scales and some cranial bones. However, some morphometric characteristics presented by Miller for this purpose do not always allow unequivocal subspecies determination. Nowadays, *S. b. snyderi* and virtually indistinguishable *S. b. obesa* x *S. b. snyderi* hybrids create conservation uncertainties in the Owens River basin. In the present study, the shape of bones with taxonomic value is analyzed using geometric morphometrics to distinguish both parental subspecies and their hybrids in populations diagnosed by Chen et al. (2007, Conserv Genet 8:221–238) using microsatellite DNA. Scales, dentaries and pharyngeal arches of 109 individuals from 11 localities of the Owens River and other nearby basins were compared. Geometric morphometric analysis provided variable discriminatory power between subspecies, depending on the studied bone. The scales (easily and harmlessly removable in vivo) showed the greatest discrimination, followed by the pharyngeal arches and dentaries. In every case, the morphological patterns are in agreement with the diagnostic characters set forth by Miller.

La amenazada carpa tui del Owens, *Siphateles bicolor snyderi*, fue descrita por RR Miller en 1973 como endémica de la cuenca del Río Owens en el este de California, distinguiéndola de otras subespecies de *S. bicolor* (Girard, 1856) por medio de características morfológicas de las escamas y algunos huesos craneales. Sin embargo, algunos de los caracteres morfométricos expuestos por Miller para ello, no siempre permiten una distinción inequívoca de las subespecies. En la actualidad, *S. b. snyderi* y los híbridos prácticamente indistinguibles *S. b. obesa* x *S. b. snyderi* presentes en la cuenca del Río Owens generan incertidumbres para la conservación. En este trabajo se analiza mediante técnicas de morfometría geométrica la forma de las estructuras óseas con valor taxonómico que permitan distinguir ambas subespecies parentales y sus híbridos en poblaciones previamente identificadas por Chen et al. (2007, Conserv Genet 8:221–238) empleando DNA microsatélite. Se compararon las escamas, dentarios y arcos faríngeos de 109 ejemplares de 11 localidades de la cuenca del Río Owens y otras cuencas adyacentes. El análisis de morfometría geométrica proporcionó diferentes resultados de discriminación de las subespecies, en función de las piezas utilizadas. Las escamas (extraíbles fácilmente in vivo sin dañar al ejemplar) fueron la estructura que mejores resultados proporcionó, seguida de los arcos faríngeos y los dentarios. En todos los casos, los patrones morfológicos son concordantes con las características diagnósticas descritas por Miller.

Fundulus sp. nov. (Teleostei: Fundulidae) de la Cuenca del Río Soto La Marina, Nuevo León, México

García-Ramíez, María E. [1], Contreras-Balderas, Salvador [2], Lozano Vilano, María de L. [3]. (1-Universidad Autonoma de Nuevo Leon, 2-Bioconservacion A.C.).

En el presente trabajo se reporta una nueva especie no conocida para el complejo Fundulus grandis en el NE de México. En 1997 la forma de Fundulus encontrada en esta cuenca fue reportada como sp. El objetivo planteado fue dilucidar la relación de las poblaciones montañosas con la costera. Se examinaron un total de 498 ejemplares de los cuales se tomaron medidas biométricas a 151 de los ejemplares de Fundulus se compararon y cuantificaron. Se tomaron 51 características de las cuales 35 son morfometricas y 16 mirísticas; la morfometría fue tomada con vernier de puntas Fowler Kal 2 # 54-100-006, además se realizó un análisis discriminante con el SPSS v 10.0 para Windows. Este estudio sistemático se propuso para definir el estatus taxonómico que le corresponden a las formas de Fundulus encontradas en esta región del país. Los resultados de éste estudio comparados con F. grandis muestran que los ejemplares de la localidad de Marmolejo se caracteriza por la presencia de de barras sencillas y conspicuas, cuerpo engrosado y alto; anchura de la boca grande; ojo chico (4.9 veces en la longitud cefálica); distancia preorbital amplia; base de la aleta pectoral grande; distancia larga del rostro-origen pélvica; amplia distancia origen dorsal-origen pectoral. Este trabajo nos muestra que la fisonomía de Fundulus de Marmolejo es diferente a la forma grandis y esta correlacionada a que se encuentra en un hábitat frío, tomando en cuenta que su relación mas cercana es con F. grandis y es costero. Palabras clave: Fundulus, Marmolejo, Río Soto La Marina, nueva especie

The Fishes of Texas Project

Hendrickson, Dean A. [1], Cohen, Adam E. [1], Dugan, Laura [2], Garrett, Gary P. [3], Edwards, Robert J. [4]. (1-University of Texas, Texas Natural History Collection, Austin, Texas, USA, 2-University of Texas, Section of Integrative Biology, 3-Texas Parks and Wildlife, Heart of the Hills Research Station, 4-University of Texas Pan American, Biology).

The Fishes of Texas database compiled by the Texas Natural History Collection at The University of Texas Austin consists of 65,876 freshwater records vouchered by specimens curated at 34 U.S., Mexican and European collections, many unavailable online or in computerized format. An estimated 95% of all fish specimens ever collected in Texas since 1854 are represented, as are all known Texas freshwater species. All but 28 of Texas' 254 counties are represented in the 20,664 total localities, all now manually georeferenced. Locality plots reveal significant spatial gaps, and temporal distribution of sampling is similarly uneven, peaking 1950 – 1970 then sharply declining. Post 1980, 27% of counties were not sampled at all and 90% were sampled

Freshwater fishes of Mojave River, California: past and present

Henkanaththegedara, Sujan M. [1], Seigel, Jeffrey A. [2], Hughson, Debra L. [3], Parmenter, Steve [4], Huffine, Matthew [5], Stockwell, Craig A. [1]. (1-North Dakota State University, Biological Sciences, 2-Natural History Museum of Los Angeles County, 3-National Park Service, Mojave National Preserve, 4-California Department of Fish and Game, 5-Academy For Academic Excellence, Mojave River Campus, Lewis Center For Educational Research).

The Mojave River, California historically was inhabited by only one native fish, the Mohave tui chub, *Siphateles bicolor mohavensis*. This species was extirpated from the Mojave River by the 1960's and currently persists in four highly modified isolated habitats. Non-native fishes have entered the Mojave River watershed through a combination of deliberate introduction, and incidental to inter-basin connection via the California Aqueduct. Arroyo chub, *Gila orcutti* appeared in the Mojave River in 1930's, presumably as a released bait fish and hybridized with native Mohave tui. By 2002, 23 non-native species were reported in the Mojave River drainage. We conducted surveys to determine the existing fish species in the middle and lower reaches of the river (respectively Mojave Narrows and Afton Canyon), in order to assess the suitability of the river for a potential reintroduction of Mohave tui chub. We did not observe *S. b. mohavensis* in either place. We found a total of six exotic species which belong to five families (Cyprinidae, Gasterosteidae, Ictaluridae, Centrarchidae and Poeciliidae) and some presumed hybrids between existing cyprinids. Two of these species occurred in Afton Canyon with one species dominating the catch, while all six were present in Mohave Narrows.

Métodos estandarizados para el muestreo de peces dulceacuícolas de Norteamérica

Mercado-Silva, Norman [1], Bonar, Scott A. [1]. (1-Arizona Fisheries and Wildlife Cooperative Unit, School of Natural Resources, University of Arizona).

Standardization in industry, medicine and science has led to great advances. However, despite its benefits, freshwater fish sampling is generally unstandardized, or at most standardized locally. Standardization across large regions would allow for measurement of large-scale effects of climate or geography on fish populations; larger sample sizes to evaluate management techniques; reliable means to document rare species; easier communication; and simpler data sharing. With increased interaction among fisheries professionals worldwide, reasons for wide-scale standardization are more compelling than ever. The Fish Management Section of the American Fisheries Society in collaboration with the U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, U.S. Bureau of Land Management, National Park Service, USGS Cooperative Research Units Program, National Fish and Wildlife Foundation, AFS Education and Computer User's Sections, and Arizona Game and Fish Department is developing a book of standard sampling methods for North America. Almost 50 Mexican, Canadian, and United States sampling experts are authors. *Standard Methods for Sampling North American Freshwater Fishes* describes standard methods to sample fish in specific environments so population indices can be more easily compared across regions and time. Environments include ponds, reservoirs, natural lakes, streams and rivers containing cold and warmwater fishes. This book provides rangewide and regional averages; calculated from over 4000 data sets from 42 states and provinces; of size structure, CPUE, growth, and condition for common fishes collected using methods discussed. Biologists can use these data to determine if fish from their waterbody are below, above, or at average for an index. These methods were reviewed by 54 representatives from 33 North American agencies and by biologists from five European and one African countries. Final drafts were reviewed by an additional 36 sampling experts. These procedures will be useful to those hoping to benefit from standard sampling programs in their regions.

El proceso de estandarización ha llevado a grandes avances en la industria, la medicina y las ciencias. Sin embargo, el muestreo de peces dulceacuícolas generalmente no es estandarizado. La estandarización de métodos de colecta en grandes regiones geográficas puede 1) permitir el estudio del efecto de procesos climáticos o geográficos de gran escala sobre las poblaciones de peces, 2) permitir la construcción de grandes bases de datos para evaluar estrategias de manejo, 3) permitir la creación de mecanismos efectivos para documentar especies raras, y 4) facilitar la comunicación y comparación de datos. Ante una mayor colaboración entre personas dedicadas al estudio de pesquerías de agua dulce a nivel mundial, los procesos de estandarización son más necesarios que nunca. La Sección de Manejo de Pesquerías de la Sociedad Americana de Pesquerías, en colaboración con el U.S. Fish and Wildlife Service, y otras 7 agencias estatales, federales y no gubernamentales han producido un libro acerca de métodos estandarizados de colecta de peces dulceacuícolas para Norteamárica. Casi 50 científicos expertos mexicanos, canadienses y norteamericanos han contribuido con esta publicación. El libro *Standard Methods for Sampling North American Freshwater Fishes* describe métodos estandarizados para la colecta de peces en ambientes específicos, lo que facilita la comparación de parámetros de poblaciones de peces entre diferentes regiones y tiempos. Los ambientes que se tratan en el libro incluyen lagos naturales, presas, arroyos y ríos que contienen especies de aguas frías y templadas. El libro presenta además los valores promedio de la estructura de tallas, capturas

por unidad de esfuerzo, crecimiento y condición para muchos peces comunes en Norteamérica. Estos valores han sido calculados a partir de 4000 bases de datos de 42 estados y provincias. Los datos pueden ser utilizados para determinar si los parámetros de una población particular son mayores, menores o iguales a las medias para una región. Los métodos de estandarización fueron revisados por 54 representantes de 33 agencias en Norteamérica y por biólogos en 5 países en Europa y uno en África. Los capítulos finales fueron revisados por otros 36 expertos en el muestreo de peces. Estos procedimientos serán útiles para aquellos interesados en beneficiarse de programas de muestreo estandarizado en sus regiones respectivas.

Fish community structure in relation to environmental factors on a Biosphere Reserve of Hidalgo State (Hidalgo, Mexico)

Miranda, Rafael [1], Galicia, David [1], Vilches, Antonio [1], Bautista-Hernández, Christian E. [2], Monks, Scott [2], Pulido-Flores, Griselda [2], Gaspar, Sergio [3], Leunda, Pedro M. [4]. (1-University of Navarra, Department of Zoology & Ecology, 2-Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Hidalgo, México, 3-Universidad de la Amazonía, Colombia, 4-GAVRN, S.A.).

The Barranca de Metztitlán Biosphere Reserve (Central Mexico) is a transition zone from Neotropic to Nearctic regions, with a combination of characteristics, flora and fauna of both. This great diversity of habitats, with the presence of numerous endemic species, has made the Reserve a place of great ecological and scientific importance. Several studies of the fauna and flora of this area have been made, but none of them focused on fishes. For this research, thirty one sites were sampled by means of electrofishing surveys in several river systems of the. Captured fish were identified, measured, and weighted before being returned to their habitat. Results show the presence of at least 13 species in Metztitlán: three introduced for human consumption (common carp, *Cyprinus carpio*, common bream, *Abramis brama* and tilapia, *Oreochromis niloticus*), three translocated to the reserve (charal, *Chirostoma jordani*, porthole livebearer, *Poeciliopsis gracilis* and green swordtail, *Xiphophorus helleri*); and seven native (shortfin molly, *Poecilia mexicana*, barred killifish, *Heterandria jonesi*, mexican tetra, *Astyanax mexicanus*, lantern minnow, *Dionda ipni*, mountain mullet, *Agnostomus monticola*, catfish, *Ictalurus sp.*, dusky splitfin, *Goodea sp.* and curve-bar cichlid, *Herichthys sp.*). Besides, relationship between the structure of fish communities and 13 environmental variables were examined. A canonical correspondence analysis revealed gradients in species composition and abundance related to altitude and river types. The results suggest that habitat features play an important role in the distribution and abundance of fish communities. The conservation of this habitat features should be considered in the fish management and conservation plans of the Barranca de Metztitlán Biosphere Reserve.

La Reserva de la Biosfera Barranca de Metztitlán (México Central) es una zona de transición entre las regiones Neártica y Neotropical, con una combinación de las características, flora y fauna de ambas. Esta gran diversidad de hábitats, con la presencia de numerosos endemismos, ha hecho de la Reserva un lugar de gran importancia científica y ecológica. Se han realizado algunos estudios de la fauna y flora de esta área, pero ninguno de ellos enfocado en los peces. Para este estudio, se muestrearon 31 lugares mediante censos de pesca eléctrica en varios sistemas fluviales de la Reserva. Los peces fueron capturados, identificados, medidos y pesados antes de ser devueltos a su hábitat. Los resultados muestran la presencia de al menos 13 especies en Metztitlán: tres introducidas para consumo humano (la carpa común, *Cyprinus carpio*, la brema común, *Abramis brama* y la tilapia del Nilo, *Oreochromis niloticus*), tres translocadas a la reserva (el charal, *Chirostoma jordani*, el guatopote jarocho, *Poeciliopsis gracilis* y el cola de espada, *Xiphophorus helleri*); y siete nativas (el topote del Atlántico, *Poecilia mexicana*, el guatopote listado, *Heterandria jonesi*, la sardinita mexicana, *Astyanax mexicanus*, la trucha de tierra caliente, *Agnostomus monticola*, la carpa veracruzana, *Dionda ipni*, el pez gato *Ictalurus sp.*, el tiro, *Goodea sp.* y la mojarra huasteca, *Herichthys sp.*). Por otro lado, se examinaron las relaciones entre la estructura de las comunidades de peces y 13 variables ambientales. Un análisis de correspondencias canónicas revela un gradiente en la composición y abundancia de las especies relacionado con la altitud y los tipos de cursos fluviales. Los resultados sugieren que las características de los hábitats juegan un importante papel en la distribución y abundancia de las comunidades piscícolas. La conservación de los hábitats y sus características deberían ser consideradas en los planes de manejo y conservación de los peces dentro de la Reserva de la Biosfera de la Barranca de Metztitlán.

2008 Nevada Area Report

Miskow, Eric, S [1], Goodchild, Shawn [2], Hobbs, Brian [3], Sjoberg, Jon [3], Potter, Dave [2], Petersen, Jeff [3]. (1-Nevada Natural Heritage Program, 2-U.S. Fish and Wildlife Service, 3-Nevada Department of Wildlife).

Overview and status of Nevada's desert fishes, rare amphibians; current research and management projects in the state. Brief updates on the population status and management of key Nevada native aquatic animals are presented. Restoration and refuge construction continued at Ash Meadows for a variety of endemic species, including two major rotenone projects. Ongoing habitat modifications and restoration projects in the Muddy River Warm Springs complex continue to increase suitable habitat for the endangered Moapa dace, *Moapa coriacea*; however, the most recent population surveys have shown a precipitous decline in numbers. A major investigation into demographics and habitat use by the endangered Big Springs spinedace, *Lepidomeda mollispinis pratensis*, in Condor Canyon is ongoing, and habitat enhancement has been planned for the Pahrump poolfish, *Empetrichthys latos* , at Shoshone ponds. A five year review on the status of the endangered Independence Valley speckled dace, *Rhinichthys osculus lethoporus*, has just been completed, along with more recent information on the Independence Valley tui chub, *Siphateles bicolor isolata*, which co-occur in Elko County, Nevada. Survey data on the Amargosa toad *Anaxyrus nelsoni* and the Columbia spotted frog *Rana luteiventris* are summarized. In addition to species updates, restoration efforts that enhance habitats for the Wall Canyon sucker, *Catostomus sp.* and the Railroad Valley springfish, *Crenichthys nevadae* are discussed.

Are spotting patterns used as a cue in mate choice and species recognition in the livebearing fish *Poeciliopsis baenschi*?

Scott, Laura E. [1], Camargo, Ashley [1], Stilson, Kent [1], Johnson, Jerald B. [1]. (1-Brigham Young University, Department of Biology).

Conspecific mate recognition in sympatric environments should be strongly selected for to avoid the deleterious effects of hybridization with other species. Cues used in mate choice recognition can include stereotypic behaviors or pigmentation patterns. In the livebearing fish genus Poeciliopsis, species vary significantly in their pigmentation patterns. Most patterns include horizontal and vertical bars, spots, a combination of the both, or no observed pattern. *Poesciliopsis baenschi*, is a species found in central-western Mexico that co-occurs with a close relative, *P. turneri*. Both species are superficially similar in their pigmentation patterns; they are described as having 3-7 or 6-10 (respectively) bars or spots on their lateral flank. However, given that these species exist in sympatry, we suspect that subtle differences in their pigmentation patterns could play a role in mate choice or conspecific recognition. In this study, we test the hypothesis that spotting patterns are more different in sympatry than in allopatry by quantifying variation in pigmentation patterns between allopatric and sympatric populations. This work preludes our current research to determine in live fish if differences in spotting patterns are actually used as cues in mate choice and species recognition.