38 *th* Annual Meeting

15-18 November 2006

Death Valley, California

Desert Fishes Council

Consejo de los Peces del Desierto

Wednesday, 15 Nov. 2006

08:00 - 15:30	**Three Species Range-wide Coordination Team 2006 Annual Meeting** Oasis Room at Furnace Creek Inn, located on hill to the east of Furnace Creek Ranch	
17:00 - 20:00	**Registration and reg. package pickup**	Desks in front of Visitor Center
17:00 - 00:00	**Informal gatherings and discussions**	Furnace Creek Bar, pool area, rooms …

Thursday, 16 Nov. 2006

08:30 - 09:00	**OPENING REMARKS**	Visitor Center Auditorium
09:00 - 12:00	**GENERAL SESSION - 1**	Visitor Center Auditorium
12:00 - 13:30	**LUNCH**	
13:30 - 17:00	**GENERAL SESSION - 2**	Visitor Center Auditorium
18:30 - 22:00	**EVENING DISCUSSION SESSION - Desert Fish Habitat Partnership** Oasis Room at Furnace Creek Inn, located on hill to the east of Furnace Creek Ranch	

Friday, 17 Nov. 2006

08:30 - 12:00	**GENERAL SESSION - 3**	Visitor Center Auditorium
12:00 - 13:30	**LUNCH**	
13:30 - 16:30	**GENERAL SESSION - 4**	Visitor Center Auditorium
16:30 - 17:00	**POSTER SESSION**	Visitor Center Auditorium
17:00 - 18:00	**BUSINESS MEETING**	Visitor Center Auditorium
19:00 - 00:00	**BANQUET**	The Date Grove between Furnace Creek Ranch & Visitor Center

Saturday, 18 Nov. 2006

08:30 - 12:00	**GENERAL SESSION - 5**	Visitor Center Auditorium
12:00 - 13:30	**LUNCH**	
13:30 - 17:00	**SPECIAL SESSION - Devil's Hole, Captive & Refuge Populations** Visitor Center Auditorium	
18:30 - 22:00	**EVENING DISCUSSION SESSION - Captive and Refuge Populations** Oasis Room at Furnace Creek Inn, located on hill to the east of Furnace Creek Ranch	

Sunday, 19 Nov. 2006

08:00 -	**FIELD TRIP to Ash Meadows**	Visitor Center Parking Lot

Wednesday, 15 Nov. 2006

08:00 - 15:30 **Three Species Range-wide Coordination Team 2006 Annual Meeting**
Location: Oasis Room at Furnace Creek Inn, located up on the hill to the east of Furnace Creek Ranch and the Visitor Center.

17:00 - 20:00 **Registration and reg. package pickup**
Location: Desks in front of Visitor Center.

17:00 - 00:00 **Informal gatherings and discussions**
Location: unspecified - Furnace Creek Bar, pool area, rooms …

Thursday, 16 Nov. 2006

08:30 - 09:00 **OPENING REMARKS**
Location: Visitor Center Auditorium.

09:00 - 12:00 **GENERAL SESSION - 1**
Location: Visitor Center Auditorium.

09:00 **Edwin P. (Phil) Pister, the man and his work**
Brittan, Martin R.*[1]. (1-California State University, Sacramento (emeritus)).

Phil Pister is best known today as a founder of the Desert Fishes Council and its current Executive Secretary, and as a leader in conservation ethics. He is also a prolific speaker and author on fisheries and environmental issues. Phil was born in Stockton, California, on January 15, 1929, his parents encouraging, as he grew up, his interest in hiking, hunting, and the great outdoors. The family spent much time in the adjacent Sierra Nevada Range, especially at Tuolumne Meadows in Yosemite National Park. An influential high school teacher was Harry Snook, who had received an M.A. in genetics from the University of California, Berkeley, and who was co-author, with Myrtle Johnson of San Diego State College, of the popular Seashore Animals of the Pacific Coast. In 1946, Phil entered the traditional university of his family, U.C., Berkeley, majoring in Wildlife Conservation, and received his A.B. degree in 1951, later working toward a Masters degree in Zoology, with a specialty in Aquatic Biology. At Berkeley, he was influenced by a number of outstanding professors, among them A. Starker Leopold, a wildlife biologist, and son of Aldo Leopold; Paul Needham, author of Trout Streams; Robert Usinger, an aquatic entomologist, and author of Aquatic Insects of California; botanist Lincoln Constance; and legendary chemist Joel Hildebrand. Among his fellow students during his undergraduate and graduate years were Norman "Sam" Reimers, Dana Abell, Stan Weitzman, Harry Kennedy, John Maciolek, Kent Carnie, and Earl Hubbs, all of whom went on to distinguished careers in biology.

During the summers of 1950 through 1952, Phil, with Reimers, Kennedy, and Maciolek, worked out of the Convict Creek Experiment Station (now the Sierra Nevada Aquatic Research Laboratory) of the U. S. Bureau of Sport Fisheries and Wildlife (now

the U.S. Fish and Wildlife), located just downstream from Convict Lake, on the east side of the Sierra Nevada near Mammoth Lakes, in the high country of the Convict Lake basin. Their work was published as Fishery Bulletin 103 of the U.S. Fish and Wildlife Service, Limnological Study of the Lakes in Convict Lake Basin, Mono County, California (1955). This stands yet as one of the best high-altitude lake studies ever done.

Phil's job, and pursuit of the Ph.D., ended in early 1953, when the Eisenhower Administration cut all temporary appointments in fhe Fish and Wildlife Service, causing him to accept a temporary position as Assistant Fishery Biologist with the California Department of Fish and Game in Bishop, then taking, in 1955, a promotion to the South Fork of the Eel River Cedar Creek Experimental Hatchery in Garberville. But the mountains and deserts lured Phil and his wife, Martha, back to Bishop in 1957, and here they have remained.

Phil's employees at Bishop included Darrell Wong, Dave Soltz, Walter Reid, Nadine Kanim, Bob Brown, Fred Partridge, David Kenagy, John Deinstadt, and Randy Benthin, all who have had successful agency and academic careers.

Phil spent 35 years in Bishop with the Department of Fish and Game, and combined with his work with the 300-member Desert Fishes Council became a leader in the revolt against traditional, game fish, productivity-oriented fisheries management, in which "trash" or "rough" fish became non-game fish, and the importance of a healthy, supportive environment became recognized. As his work expanded, he came in contact with Mexican biologists such as Salvador and Armando Contreras-Balderas, Lourdes Lozano-Vilano, and students such as Gorgonio Ruiz. Phil has always been an enthusiastic supporter of bringing Mexican ichthyologists into cooperative efforts with their American colleagues.

Since retiring in 1990, Phil continues to direct the administrative affairs of the DFC, and teaches and lectures widely and often. He has kept up-to-date by taking numerous in service training courses, and by actively immersing himself in conservation activities, in the-field and political. Phil has taught 30 short courses at government agencies and universities, and 85 university departmental seminars and invited lectures. His 70 publications lean heavily to rare and endangered desert fishes and habitats, wild trout, and environmental ethics. He served several stints as editor of the Proceedings of the Desert Fishes Council and has also served on the governing boards of the Society of Conservation Biology and the American Society of Ichthyologists and Herpetologists.

Besides Phil's key participation in the saving of the Ash Meadows fishes and the creation of the Golden Trout Wilderness, two incidents stand out, the "fish in a bucket" saving of the remaining population of the Owens Pupfish, Cyprinodon radiosus. In the first, in August, 1969, Bob Brown rushed into Phil's office, and told Phil that the surviving pupfish were in deep trouble. Phil, Bob, and John Deinstadt rushed out to Fish Slough just north of Bishop and netted the last 800 fish and placed them in live cages in an area with adequate flow. The others having returned to Bishop, Phil found himself temporarily alone, with conditions worsening. Phil carried the last surviving fish in two buckets, stumbling from an oxygen-poor, over-warm source to a fresh spring, conscious of the fact that he held the species' fate in his hands. In the second, Phil engineered the return of Colorado River Cutthroat Trout, Oncorhynchus clarki pleuriticus, from the Williamson lakes in the California High Sierra to Bench Lake in their native range in Rocky Mountain National Park, in which they had become extirpated. Phil hiked; the fish flew out by helicopter!

Phil remains a leader in his field, and an inspiration to students of western fishes and to environmentalists everywhere.

09:15 **Impact of the Desert Fishes Council in México, after the first meeting Monterrey**
Contreras-Balderas, Armando*[1]. (1-Universidad Autónoma de Nuevo León, F.C.B.).

Since 1979, when we had the first meeting of the Desert Fishes Council in Monterrey, the emotional and professional impact of the Council's meetings has been considerable. Many students who attended have continued their studies in desert fishes in México. This has been, in great part, due to the motivation of the personality of Phil Pister and the opportunity to meet other important ichthyologists, such as Dr. Robert R. Miller, Dr. Clark Hubbs, Dr. Royal D. Suttkus, James E. Deacon, Wendell L. Minckley, Dr. Martin R. Brittan, Dr. Anthony Echelle and M. Sc. Alice Echelle, as well as a few young specialists such as Dr. Gary P. Garret, Dr. Dean Hendrickson, Dr. Robert J. Edwards, and other even younger North American and Mexican ichthyologists. After the second meeting of DFC in Monterrey, additional students were motivated to work towards the conservation of desert ecosystems, in great degree once again, to the enthusiasm and personality of Phil Pister and other researchers of the Council. Now, after the Cuatrocienegas meeting in 2005, even more people in México have an interest in this unique area and in desert ecosystems. With future meetings in Death Valley and Cuatro Cienegas, I think more professional ichthyologists and students will be conducting studies of desert fishes in México. Congratulations and acknowledgements are due to DFC for its consideration of Monterrey, Cuatrocienegas and other Mexican locations for future meetings.

09:30 ***Fundulus* n. sp. (Teleostei: Fundulidae) from the Río San Fernando Basin, Nuevo León, México**
García-Ramírez, Maria Elena[1]; Contreras-Balderas, Salvador[2]; Lozano-Vilano, Maria de Lourdes*[1]. (1-Universidad Autónoma de Nuevo León, F.C.B.; 2-Universidad Autónoma de Nuevo León, Bioconservación).

Fundulus n. sp. is an endemic fundulid fish from the spring and marshes known as Baño de San Ignacio, Río San Fernando Basin, Nuevo León, México. Geologically, the locality is in the Tamaulipan Platform province. The isolation and thermal water habitat, rich in sulphur salts, are important factors in differentiation of this species. Its closest relative is *Fundulus grandis*, a coastal form. The new species is characterized by a high number of conspicuous bars (commonly in inverted V's or U's), very convex dorsal profile, acute head profile, eye larger than snout; head scales regular; a broad interorbital (2.4 times in head length), short dorsal fin; ample throat bar, pectoral fin base behind the opercle and rounded pectoral fins.

Fundulus n. sp., es un pez fundulido endémico del área de pantano conocida como Baño de San Ignacio, de la cuenca del Río San Fernando, Nuevo León, México. Geológicamente se ubica en la provincia de la plataforma de Tamaulipas. El aislamiento, y el hábitat de aguas termales ricas en compuestos azufrados es un factor importante en la diferenciación de esta especie. Su relación más cercana es con la especie costera Fundulus grandis. *Fundulus* nsp. se caracteriza por la presencia de barras conspicuas; cuerpo con perfil dorsal convexo; perfil cefálico redondeado; las escamas de la cabeza

presentan disposición regular; distancia ínter-orbital más amplia (2.4 en longitud cefálica); base aleta dorsal corta; barra gular amplia, base de las aletas pectorales por detrás del opérculo, bordes de las pectorales redondeados.

09:45 **Desert fishes research and management in Texas during 2006**

Garrett, Gary P.*[1]; Edwards, Robert J.[2]; Allan, Nathan L.[3]; Hubbs, Clark[4]. (1-Texas Parks and Wildlife Department; 2-University of Texas – Pan American; 3-U.S. Fish and Wildlife Service; 4-University of Texas at Austin).

Numerous issues relative to the conservation and management of desert fishes have come to the forefront in Texas. Challenges brought on by drought and water marketing initiatives have led to a concentration of efforts in the Devils River region of the state. This unique ecoregion is home to several state listed species, species of concern, a federally threatened fish and one that has been petitioned for listing as endangered. In addition to threats posed by lack of water, the exotic suckermouth catfish (*Hypostomus* sp.) is an additional cause for concern.

10:00 **New Mexico Area Report: Upper/Middle Rio Grande and Pecos rivers, including Arkansas, Tularosa and Guzman basins**

Brandenburg, Howard W.*[1]; Brooks, Jim E.[2]; Davenport, Steve R.[2]; Remshardt, Jason W.[2]; Propst, David L.[3]; Carman, Stephanie M.[3]; Platania, Steve P.[4]; Dudley, Robert K.[4]. (1-University of New Mexico, Museum of Southwestern Biology, Divsion of Fishes; 2-U. S. Fish and Wildlife Service, New Mexico Fishery Resource Office; 3-New Mexico Department of Game and Fish; 4-American Southwest Ichthyological Researchers).

Drought conditions in the upper/middle Rio Grande Basin (New Mexico) continued during the winter 2005, spring and early summer 2006. As a result there was great concern about the likelihood of dewatering large sections of the Rio Grande and losing a large number of Rio Grande silvery minnow, *Hybognathus amarus*, spawned in 2005. There was virtually no spring run-off in 2006, which is necessary for successful spawning and recruitment of Rio Grande silvery minnow. Salvage efforts for Rio Grande silvery minnow were initiated in early May as sections of the Rio Grande began to dry. Spawning periodicity studies conducted by American Southwest Ichthyological Researchers (ASIR) documented localized Rio Grande silvery minnow spawning events during brief peaks in discharge caused by localized rain events. The drought was broken by heavy monsoons that began in early July and continued through August bringing much needed rain to the state and keeping the upper/middle Rio Grande wetted.

New Mexico Department of Game and Fish (NMDGF) and U.S. Fish and Wildlife Service (USFWS) treated portions of the West Fork of the Gila River to remove non-native salmonids in preparation for reintroduction of Gila trout, *Onchorhyncus gilae*. Additional Gila trout recovery actions included sampling of the Whiskey Creek population for transplant into a replicate stream in a separate sub-basin of the upper West Fork. Planned augmentation efforts included stocking of two Gila trout lineages in the fall of 2006. Work in the Gila River drainage was also initiated following the guidelines in the recently completed state recovery plan for roundtail chub, Gila robusta, Gila chub, Gila intermedia, and headwater chub, Gila nigra. Gila chub was listed as federally endangered in November 2005.

In the San Juan River Basin, recovery efforts undertaken by NMDGF for roundtail chub (*Gila robusta*) included population and habitat surveys on several tributaries of the San Juan River during summer 2006. Larval fish surveys conducted by Museum of Southwestern Biology, Division of Fishes (UNM) personnel on the San Juan River documented the eighth consecutive year that razorback sucker, *Xyrauchen texanus,* have spawned. Despite extensive Colorado pikeminnow, *Ptychochielus lucius,* stocking efforts very few larval Colorado pikeminnow have been documented in the San Juan River. Removal of non-native ichthyofauna in the San Juan was conducted by USFWS.

The USFWS, U.S. Army Corps of Engineers, UNM, and NMDGF collected several hundred Pecos bluntnose shiner, *Notropis simus pecosensis,* from the Pecos River in May 2006 and transferred these fish to Dexter National Fish Hatchery and Technology Center. The fish were held in the event of surface flow intermittence in the Pecos River during the summer and fall months. Surveys conducted by NMDGF in the lower Pecos River showed a decline in population levels of blue sucker, *Cycleptus elongatus,* and grey redhorse, *Moxostoma congestum*.

An extensive ichthyofaunal survey is currently being conducted in the South Canadian River in northeastern New Mexico. The survey, conducted by ASIR and NMDGF, includes collections of fish in the main stem South Canadian River and its major tributaries. Among the ichthyofauna in this system are federally listed Arkansas River shiner, *Notropis girardi,* and three state listed taxa, Southern redbelly dace, *Phoxinus erythrogaster,* Arkansas River specked chub, *Macrhybopsis aestivalis tetranemus,* and suckermouth minnow, *Phenacobius mirablis.*

10:15 **NE México Area Report - Water problems in Cuatro Ciénegas, the situation**
Contreras Balderas, Salvador*[1]. (1-Bioconservación, A.C.).

Cuatro Ciénegas has been recently very much in the news throughout México. Water levels, especially in the Churince system, have dropped to the lowest levels ever seen by living residents, and, at least in the press coverage, this has been attributed to groundwater pumping for alfalfa production in the valley to the south, El Hundido. Government action is difficult due to the fact that hydrologic studies have been controversial, with independent conclusions on both sides; that the two valleys are connected and that they are not.

10:30 **Partnering for Railroad Valley springfish conservation**
Nielsen, Bridget*[1]; Sjoberg, Jon[2]; Hobbs, Brian[3]; Millett, Jerry[4]; Sanchez, Virginia[5]; Scoppettone, Gayton G.[6]. (1-U.S. Fish and Wildlife Service; 2-Nevada Department of Wildlife; 3-Nevada Department of Wildlife; 4-Duckwater Shoshone Tribe; 5-Duckwater Shoshone Tribe; 6-U.S. Geological Survey, Biological Resources Division).

Nevada is known by most people for its expansive sagebrush ocean, lonely highways, and the bright lights of Las Vegas but is rarely recognized for its unique assortment of endemic fishes, especially those species that are found in the loneliest recesses of the state. The Railroad Valley springfish is found in the dry, desolate, heartland of central Nevada where water bubbles up in the form of isolated springs and is owned by the Nevada Department of Wildlife, private individuals and tribes. The history of conservation for this unique species has been tumultuous and riddled with controversy

but in recent years, the Duckwater Shoshone Tribe, biologists, private landowners, and state and federal agencies have found common ground through the Railroad Valley Recovery Implementation Team (RRRIT) partnership. Unwilling landowners, battles over water rights, habitat modification, and the construction of a catfish farm within designated critical habitat were all monumental challenges that have been overcome through the development of this partnership. Actions implemented through the RRRIT have included land acquisitions, memoranda of understanding, procurement of grants, the implementation of habitat restoration projects, acquisition of additional scientific data, and the development of Safe Harbor Agreements which will ensure the long-term survival of the Railroad Valley springfish. Although the RRRIT team has made great progress moving towards recovery of the species, there are more actions that must be implemented and demonstrated to be successful before the Railroad Valley springfish can be delisted including the restoration and recovery of springfish at Little Warm spring, Hay Corral spring, North spring, Big spring, and Reynolds spring.

10:45 **Lower Colorado River Area Report, November 2005-2006**
Sponholtz, Pamela*[1]. (1-U.S. Fish and Wildlife Service).

Despite regional challenges brought on by climatic events such as drought, fire, and flooding, native fish conservation activities progressed this past year within an environment of cooperation between agencies and individuals. However, these efforts have not appeared to forestall the range wide declines of many aquatic species. The U.S. Fish and Wildlife Service published a positive 90-day finding on a petition to list a distinct population segment of roundtail chub, Gila robusta in the Lower Colorado River drainage, and to list the headwater chub, Gila nigra, as endangered in July 2005. Building on a conservation agreement signed by Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming for the two chubs, flannelmouth, Catostomus latipinnus and bluehead suckers, Catastomus discobolus, a draft conservation rangewide conservation strategy was completed in 2005. The Arizona Game and Fish Department also continued work on a statewide conservation agreement and strategy that includes roundtail and headwater chub, as well as flannelmouth, bluehead, Zuni bluehead, Pantosteus d. jarrowi, and Little Colorado River suckers, Catostomus sp. Invasive species management focused on Salvinia removal in the Lower Colorado River, which was initially discovered in Palo Verde drain in 1999, and has moved throughout the river system on both National Wildlife refuges and into Mexico where it has started to impact water delivery. Flow regimes in the Colorado River in Grand Canyon, aimed at reducing numbers of nonnative trout, resulted in little detectable mortality of trout eggs and fry, however mechanical removal of nonnative fishes at the mouth of the Little Colorado River, predominantly salmonids, continued to be successful, and although results are not yet conclusive as to the benefit to native species such as humpback chub, Gila cypha. Apache trout, Oncorhynchus apache, recovery efforts have resulted in renovation of four streams this year (Bear Wallow, East Fork of the Little Colorado River, Hayground, and Fish Creek) and a total of over 46 miles ready for Apache trout stocking this fall. In New Mexico, 20 miles of the upper West Fork Gila River drainage was treated with antimycin A to remove nonnative salmonids for Gila trout, Oncorhynchus gilae, recovery. Previously, use of piscicides was banned by NM State Game Commission but work by groups such as Trout Unlimited contributed to "lifting" of the ban by the Commission. Reintroduction efforts for native species include re-establishment of the Office Cove backwater and

ponds on the Emerald Canyon Golf course near Parker for razorback suckers, Xyrauchen texanus, spinedace, Lepidomeda vittata, stockings into Dane and Bear Canyons in the East Clear Creek drainage, Gila chub, Gila intermedia, into Sabino, Bear and Romero Canyons and pikeminnow, Ptychocheilus lucius, and razorback stockings into the Verde River. Interestingly, seven razorbacks were found in Horesehoe Lake, approximately 53 miles downstream of stocking sites in the Verde River during a routine sportfish survey. In addition, Gila topminnow, Poeciliopsis o. occidentalis were introduced into a New Mexico Wildlife Area and pupfish, Cyprinodon m. macularius, were stocked into the TNC San Pedro Preserve. A cooperative effort is proceeding to reestablish native fish species and augment lowland leopard frog Rana pipiens into multiple springs and streams within the watersheds of the Muleshoe ecosystem. Effects of ongoing drought were felt in several mainstem rivers including the San Pedro where water temperatures in excess of 30ºC contributed to local extinction of desert sucker, Pantosteus clarki. Cienega Creek, which has the largest remaining Gila topminnow population in Arizona and supports Gila chub, lost 42% of its surface flows and dried for 2.5 miles before monsoon season started. The middle Santa Cruz has also been hit hard by drought and recent surveys have found only small numbers of longfin dace, Agosia chrysogaster. In response to reductions in fish populations due to fire, water withdrawals and invasive species, propagation techniques for several native fishes including Yaqui chub, Gila purpurea, and Yaqui topminnow, Poeciliopsis o. sonoriensis, are being refined and developed at the Cooperative Research Unit at the University of Arizona. Other research activities initiated in the Lower Colorado River region this past year have included initiation of telemetry surveys using bonytail chub, Gila elegans, to identify habitat use in the lower Colorado River, the effects of fire on fish habitat, investigation of mechanical removal methods for northern pike and food web dynamics at Aravaipa Creek using stable carbon and nitrogen isotopes. In addition, Asian fish tapeworm was documented in nonnative fishes above Grand Falls in the Little Colorado River and has implications for downstream management of humpback chub. Research has also found that drug concentrations used in standard protocols to de-worm fish before translocations are less than 100% effective at tapeworm removal. Finally, surveys on the Upper Verde River have found a resurgence of native species such as roundtail chub, desert and Sonora suckers, Catostomus insignis, and a reduction in nonnative species and is attributed to high flow events from this past fall and spring. However, as the summer progressed, nonnatives such as red shiner, Cyprinella lutrensis, and crayfish appear to have quickly recovered to pre-flow conditions. Renovation of Fossil Creek, highlighted in the report in 2004, is finally complete with a functional barrier, removal of nonnative fishes, and repatriation of native species. Restoration of full flows in to Fossil Creek occurred in June 2005.

11:00 **Apariques and people: facilitating community participation to promote conservation of a rare fish in the Rio Conchos headwaters**

Cortés Montaño, Citlali*[1]; Brooks, James E.[2]; Espinosa Pérez, Héctor[3]; Ramos Gómez, Mauro A.. (1-World Wildlife Fund - Mexico; 2-U.S. Fish and Wildlife Service , New Mexico Fishery Resources Office; 3-Instituto de Biología, UNAM).

The Sierra Tarahumara Forest Conservation Program is the forestry and community development component of an integrated river basin management (IRBM) project implemented by World Wildlife Fund, Mexico Program (WWF) in the headwaters of the

Rio Conchos, in Chihuahua, Mexico. Recently, the rediscovery of an undescribed species of trout (*Oncorhynchus* sp.), the Aparique or Conchos Trout in a stream within ejido Panalachi, brought the attention of scientists and conservationists to the Rio Conchos headwaters (Truchas Mexicanas whitepaper, 2006). Continued presence of native trout highlight the importance of conserving the rich biological heritage of the Sierra Madre Occidental. WWF has been working with ejido Panalachi for over two years, facilitating participatory processes for improved natural resource management and implementing forest restoration actions within the ejido land, which is part of the Conchos headwaters. After reading the March 2006 white paper (Truchas Mexicanas 2006), WWF joined the Truchas Mexicanas team in their plea for immediate action to conserve this fish species. In collaboration with the USFWS (United States Fish and Wildlife Service) and Truchas Mexicanas, WWF coordinated meetings with the ejido board, its asamblea and the ejido forester, in order to bring their attention to Aparique conservation. After the meetings, the ejido agreed to participate in trout conservation efforts, while the forester volunteered to exclude from management select streams and associated drainages where the trout were found. In July 2006, the USFWS and WWF surveyed the stream where the trout were found in March and collected individuals from at least three different year classes. Reported declines in the trout population caused by human use and recent heavy flooding likely reduced population abundance. At least two other streams in nearby drainages were identified as having potential for future conservation efforts for Conchos trout. Alternatives for conservation of this trout species include the development and implementation of a long-term management strategy, certification of a community protected area through the Comisión Nacional de Áreas Naturales Protegidas (CONANP), and implementation of economic incentives through activities like ecotourism. However, the main challenge for conservationists in Panalachi and in the Conchos headwaters is the development of appropriate strategies that generate economic incentives while conserving key biodiversity. These strategies must include community participation and outreach at their core if they are to succeed in the long-term.

11:15 **Multi-Species Conservation Plan efforts to prioritize razorback sucker and bonytail restoration sites**

Robertson, Mike*[1]; Albrecht, Brandon[1]; Holden, Paul[1]. (1-BIO-WEST).

The Multi-Species Conservation Plan for the Lower Colorado River includes stipulations that 360 “backwaters” are to be created for razorback sucker and bonytail, and 85 acres for flannelmouth sucker as part of the 50-yr management plan. Backwaters for razorback sucker and bonytail will be disconnected from the river to prevent compromise by non-native fishes and must provide suitable habitat conditions for one or both of these species. To meet the total acreage goal, existing backwaters within the LCR project area will be evaluated for feasibility of restoration. The evaluation will include determining current habitat condition of a site for razorback sucker and bonytail using a rating system that has been developed (currently in draft form) for this project. The existing habitat condition is used as an indicator of which features will require restoration and how much effort will be involved before a given backwater will be suitable to support native fishes. By rating sites in this way, they can be prioritized to focus efforts on sites with high probability of success. The rating system was developed based on existing information on habitat requirements for these species, but most information relates directly to habitat requirements within the river channel. Few published or gray

literature reports describe habitat requirements of razorback sucker or bonytail in great detail in isolated ponds, since most efforts to date have been focused on habitat conditions within the Colorado River and its impoundments (except for ponds used as "grow-out" sites). Similar efforts are proposed for restoring/creating flannelmouth sucker habitat, but even less information is available on that species' physical habitat requirements. Prior to initiating large scale rating efforts of backwaters along the Lower Colorado River a small-scale validation of the rating system for razorback sucker and bonytail was undertaken this summer. The validation effort was designed to compare the rating of habitat suitability to historical stocking success and preliminary results will be presented.

11:30 **Consultation and collaboration: Balancing water resource management with conservation of the endangered Moapa dace, *Moapa coriacea***

Marshall, Zane*[1]. (1-Southern Nevada Water Authority).

The Moapa Warm Springs in southern Nevada is a regional spring complex, which is the headwaters of the Muddy River and 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*. There is concern that development of carbonate groundwater in Coyote Spring Valley has the potential to effect discharge rates in the Moapa Warm Springs. In order 1169, the Nevada State Engineer required an aquifer test to evaluate the relationship between carbonate pumping in Coyote Spring Valley and the Moapa Warm Springs. The Southern Nevada Water Authority (Authority) proposed the construction of water facilities and applied for rights-of-way with the Bureau of Land Management to conduct this aquifer test and transport water, held by existing water rights, to the Moapa Valley Water District's (MVWD) system. This 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 focused on avoiding unreasonable effects and making measurable progress toward recovery of the Moapa dace.

11:45 **Oregon / N. California Area Report: Cow Head Tui Chubs, Private Stewardship and bad news for bass**

Reid, Stewart B.*[1]; Allen, Chris[2]; White, Rollie[2]; Smith, Roger[3]; Tinniswood, Bill[3]; Gunckel, Stephanie[4]; Scherer, Paul[4]; Munhall, Allen[5]. (1-Western Fishes; 2-U.S. Fish & Wildlife, Portland; 3-Oregon Dept Fish & Wildlife, Klamath Falls; 4-Oregon Dept Fish & Wildlife, Corvallis; 5-U.S. Bur. Land Management, Lakeview).

The northwestern extreme of the American deserts includes six interior drainage basins in Oregon and northeastern California (Fort Rock, Chewaucan, Goose, Warner, Catlow, and Alvord), which contain the remnant fish faunas of once extensive pluvial Pleistocene lakes. Species of particular conservation concern in this region include: Alvord Chub, *Siphateles alvordensis*; Borax Lake Tui Chub, *S. boraxobius*; Cow Head Tui Chub, *S. bicolor vaccaceps*; Hutton Springs Tui Chub, *S. obesus* ssp.; Foskett Dace,

Rhinichthys osculus ssp.; Modoc Sucker, *Catostomus microps*; Warner Sucker, *C. warnerensis*; Lahontan Cutthroat Trout, *Oncorhynchus clarki henshawi*; and Interior Redband trouts, *O. mykiss* sspp.. Principal conservation actions in 2005/2006 have continued to focus on population and habitat surveys of Hutton Springs Tui Chub, Borax Tui Chub, Cow Head Tui Chub, Foskett Dace, Lahontan Cutthroat Trout, Interior Redband trouts, Warner Sucker and Modoc Sucker; genetic studies of regional dace and tui chubs populations, to better understand the Foskett Dace and Cow Head Lake Tui Chub populations; fish passage projects on the Chewaucan River, to benefit the native redband trout population; screening projects in the Chewaucan and Warner basins, and exotic fish/bullfrog removal in the Turner Creek drainage containing Modoc Suckers. This year, Oregon Department of Fish and Wildlife began a radiotracking program with the Warner Sucker to determine movements and habitat use in the Warner Lakes. Overall, 2006 was a very good water year with continued stream flow, generally high recruitment and no catastrophic threats on the horizon. In October, the U.S. Fish and Wildlife Service withdrew its proposed listing of the Cow Head Tui Chub, based on improved information and the lack of threats to its continued existence. The Pit River Native Fishes Stewardship Program has started off well with over 49 miles of streams participating and 46,000 acres of private land in the program. Finally, there are only two lonely bass remaining in 18 km of the Turner Creek drainage - they are nervous.

12:00 - 13:30 LUNCH

13:30 - 17:00 GENERAL SESSION - 2
Location: Visitor Center Auditorium.

13:30 **Survey of aquatic food resources in the Middle Rio Grande, New Mexico**
Beck, Sarah*[1]; Valdez, Richard[1]; Medley, Nic[2]; Fluder, Joseph[1]. (1-SWCA Environmental Consultants; 2-New Mexico Interstate Stream Commission).

The Middle Rio Grande was surveyed to characterize temporal and spatial variations in type and abundance of food resources available to the fish community under the present ecological condition. Five subreaches were sampled (Highway 550, Alameda Bridge, South Diversion Channel, Highway 60, and San Marcial) during three seasons and flow regimes (June: spring runoff, August: summer monsoon floods, October: low flow) and a fourth sampling date is planned (December: winter base flow). Up to ten mesohabitat types were sampled within a 500-m site at each reach. Drifting macroinvertebrates, benthic macroinvertebrates, and benthic or epiphytic aufwuchs and algae were sampled at each mesohabitat type. A complete suite of samples was collected at the Alameda site to provide statistical quantification of resources, with less rigorous sampling at other subreaches.

This study serves as a baseline in several ways. First, it will aid in the design of field sampling regimes with refined methods to increase our understanding of food availability to all fish species, silvery minnow in particular. Such studies would be particularly interesting in years when hydrologic profiles differ from those in the current study. Second, this study provides a base for modeling how changes in mesohabitat and flow may affect changes in food availability. Third, it provides a basis for the design of cafeteria choice and competition studies of the feeding habits of silvery minnow. Finally,

it provides a background of availability against which to compare stomach and gut analysis studies of silvery minnow.

13:45 **Response of the Green River fish community to Flaming Gorge Dam flow and water temperature regimes**

Bestgen, Kevin R.*[1]; Zelasko, Koreen A.[1]; Compton, Robert I.[1]; Chart, Tom[2]. (1-Larval Fish Laboratory, Colorado State University; 2-U. S. Fish and Wildlife Service, Salt Lake City, Utah).

We sampled the Green River in Utah and Colorado, downstream of Flaming Gorge Dam, in 2002 to 2004 to determine the cumulative effects of flow and temperature regime changes on physical habitat and native and nonnative fish community composition since 1994 to 1996. This study was conducted because aspects of new flow and water temperature recommendations, including high flows in 1997 and 1999, and drought-induced high water temperatures in 2002 to 2004, created conditions that more closely resembled pre-dam regimes that may benefit native fishes. Native fishes in the 2002 to 2004 period comprised only 10.3% of total catch and nonnatives were 89.3%; the remaining 0.4% were hybrids. Nearly every native fish in the Green River in upstream Lodore Canyon in 2002 to 2004 declined in abundance in electrofishing, seine, and drift net samples compared to those collected in 1994 to 1996. In contrast, abundance of nonnative fishes in Browns Park and Lodore Canyon in 2002 to 2004 increased compared to the period 1994 to 1996 and were particularly evident for small-bodied cyprinids, channel catfish *Ictalurus punctatus*, and smallmouth bass *Micropterus dolomieu*. Smallmouth bass reproduction, which was not observed in Lodore Canyon prior to this study, increased through the 2002 to 2004 period and was widespread. Salmonids were temporarily reduced in abundance in the very warm year 2002, but increased again by 2003 to levels similar to the period 1994 to 1996. Abundance of hybrid suckers, including several with nonnative white sucker *Catostomus commersonii* as one parental type, was high in 2002 to 2004 and increased since the 1994 to 1996 period.

Trammel net sampling in Whirlpool Canyon detected a small population of humpback chub *Gila cypha* and a relatively large population of roundtail chub *Gila robusta*. Hatchery-stocked bonytail *Gila elegans* were also captured. Colorado pikeminnow *Ptychocheilus lucius* used Lodore Canyon heavily in summer, based on captures we made and those in a concurrent companion study, and presence of ripe males may indicate spawning there.

The net effect of recent flow and temperature regimes on the native fish community was mixed. During this study, we were able to obtain reliable information on the response of the fish community to changes in flow and temperature regimes, but only at the lower end of the flow spectrum and the high end of the temperature spectrum. Additional information is needed for other flow and temperature conditions to fully assess the effects of flow and temperature recommendations for Flaming Gorge Dam on the fish community of the Green River. Such information may also enhance understanding of factors that limit invasive predaceous fishes, which have the potential to offset hypothesized benefits of newly implemented flow and temperature recommendations.

14:00 **Status of smallmouth bass *Micropterus dolomieu* removal efforts in the middle Green River along with trends in other nonnative fish populations**
Monroe, Leisa D.*[1]; Hedrick, Trina N.[1]. (1-Utah Division of Wildlife Resources, Northeastern Regional Office, Vernal, UT).

Smallmouth bass *Micropterus dolomieu* removal efforts have been occurring in the middle Green River for three consecutive years. Attempts at a population estimate with a mark recapture method have been met with little success due to poor recapture rates of marked fish. However, trends in the bass population and our effectiveness in catching them have been observed and will be discussed in addition to trends in other nonnative fish populations.

14:15 **Entrainment of larval razorback sucker, *Xyrauchen texanus*, in three floodplains in the middle Green River**
Christopherson, Kevin D.[1]; Bestgen, Kevin R.[2]; Hedrick, Trina N.*[1]; Nelson, Pat[3]. (1-Utah Division of Wildlife Resources; 2-Larval Fish Lab, Colorado State University; 3-Program Director's Office, Upper Colorado River Recovery Implementation Program).

If recovery of razorback sucker *Xyrauchen texanus* is to occur, many researchers believe it will be through the use of floodplain or off-channel habitats. In an effort pursue this possibility, the Upper Colorado River Recovery Implementation Program (Program) has invested a great deal of time and money in breaching levees to provide floodplain access for larval fish during spring peak flows, in developing and implementing flow recommendations for Flaming Gorge Dam with regard to benefits to the endangered fish, and in researching options for removal of nonnative fish from floodplain habitats intended for use in razorback sucker recovery. In addition, the Program has begun investing time and money in researching which floodplains are the best sites for recovery and what flows will be best for entraining the largest number of larval razorback sucker. To this end, in May of 2006, we released neutrally buoyant, gelatinous beads (shown to act similarly to larvae in the river in previous studies) one mile above three flow-through floodplain sites between river miles 306 and 289 on the middle Green River (Thunder Ranch, Stewart Lake, and Bonanza Bridge). Larval fish were only released above Thunder Ranch. Crews set drift nets in one or two levee breaches at each floodplain site to estimate the number of beads and/or larvae entering the floodplain. Crews also measured inflows across the floodplain in an effort to extrapolate entrainment across the levee breach. Preliminary observations indicate that different flows are better at entraining beads and/or larvae at different sites, indicating that target flows will be different fow each site.

14:30 **How did the plains minnow replace the Rio Grande silvery minnow in the Pecos River?**
Moyer, Gregory R.[2]; Turner, Thomas F.*[1]; Osborne, Megan J.[1]. (1-University of New Mexico, Museum of SW Biology; 2-Oregon State University, Hatfield Marine Science Center).

Museum records indicate that the plains minnow, *Hybognathus placitus*, was introduced into the Pecos River, New Mexico during the early 1960s. Ten to fifteen years

later, the endemic Rio Grande silvery minnow, *Hybognathus amarus*, was extirpated from the system. We used microsatellite and mtDNA data, ecological data and modeling, and a computer simulation approach to reconstruct the history of invasion and species replacement. To identify the potential role of hybridization and introgression, we genetically screened *H. amarus* (n = 389) from the Rio Grande, NM, and *H. placitus*(n = 424) from the Pecos River, NM using four nuclear microsatellites and a partial fragment of the mtDNA ND4 gene. Genetic analyses showed that *H. placitus* was introduced into the Pecos from at least two genetically distinct source populations in the Canadian and Red Rivers, Oklahoma. Assignment tests excluded hybridization as a primary factor in species replacement and suggested a role for interspecific competition. Ecological modeling indicated that the number of founding individuals must have been between 20 and 500 individuals for *H. placitus* to have competitively displaced *H. amarus* in the Pecos River in ten to fifteen generations. Observed differences of allele frequencies between source and founder populations indicated that between 32 and 115 *H. placitus* individuals founded the Pecos River. Genetic and ecological data suggest that interspecific competition could have led to species replacement in the Pecos River.

14:45 **Assessing the impacts of non-native salmonids on Lahontan cutthroat trout in Independence Lake, and the means for their removal**

Rissler, Peter H.*[1]; Scoppettone, G. Gary[1]. (1-US Geological Survey, Western Fisheries Research Center, Reno Field Station).

Independence Lake harbors one of two remaining self reproducing lacustrine populations of Lahontan cutthroat trout (LCT), *Oncorhynchus clarki henshawi*. Results from a Population Viability Analysis (PVA) we have just completed indicated that the LCT population will be extirpated in 25 years. The introduction of non-native salmonids into the Independence Lake watershed has been implicated as the cause for LCT decline. In the second phase of our Independence Lake system research we are focusing on the effects of exotic salmonids on the LCT population, and the means of their control. Non-native brook trout (*Salvelinus fontinalis*) are abundant in the inlet stream where LCT spawn. Brook trout are being removed from the stream through an annual electro-fishing effort and survival rate of LCT fry entering the lake will be compared with rates in years before brook trout were removed from the stream. Kokanee (*Oncorhynchus nerka*) is the predominant non-native salmonid in the lake; its introduction was followed by a steep decline in the Independence Lake LCT population. The kokanee spawn only in the lake and we are using hydroaccoustic tags to monitor their depth and movement in the lake during the spawning season to locate areas used for reproduction. Our intent is to provide managers information that will allow them to disrupt kokanee spawning success in Independence Lake. Our PVA model is being used to determine preliminary benefits to the LCT population from non-native salmonid removal from the Independence Lake system.

15:00 **Fishes of the Upper Rio Tutuaca, Chihuahua, México**

Brooks, James E. Mr.*[1]; Tolle, Cindy Dr.[2]; Smith, Nick Mr.[3]; Brandenburg, W. Howard Mr.[4]; Varela Romero, Alejandro Mr.[5]; Kirkeminde, Margaret Ms.[6]; Cortes Montaño, Citlali Ms.[7]. (1-U.S. Fish and Wildlife Service, New Mexico Fishery Resources Office; 2-Tutuaca Mountain Center; 3-New Mexico Department of Game and Fish; 4-University

of New Mexico; 5-Universidad de Sonora, DICTUS; 6-U.S. Forest Service, Apache Sitgreaves National Forest; 7-World Wildlife Fund Mexico).

The Rio Tutuaca is a north to northwest flowing tributary of the Rio Aros, Rio Yaqui Basin in the Sierra Madre Occidental of western Chihuahua, MX. Here the Rio Tutuaca is generally canyon-bound, flowing through alternating reaches of long, deep pools carved in narrow bedrock corridors and wide meander bends and sparsely vegetated open valley floor. It is reported, but not substantiated, that a series of *cascadas* occur on the lower Rio Tutuaca and may serve as a potential barrier to upstream fish movement. Historical collection records for the Rio Tutuaca are predomindantly those by Dean Hendrickson during Rio Yaqui Basin surveys in the late 1970s, who observed an entirely native fish community. Additional collections originated from limited sampling during the mid 1990s by Hendrickson and others in search of native trout. The current study was undertaken to update fish community data and address resource inventory needs for ongoing land management strategies for a biologically diverse area that includes the nearby thick-billed parrot preserve located at Ejido Cebadillas. The study area encompassed the Rio Tutuaca on the downstream end near Rancho Nogal and due north of Yepachi and the upstream end was at Tutuaca, north of Tomochi. Fish community sampling was conducted 4-13 January 2006 and relied primarily upon backpack-mounted electrofishing gear. Fish community structure was characterized at eight sites on the Rio Tutuaca and ten additional samples were from tributary arroyos and spring systems. A total of 3,860 fish representing four families and six species was recorded. Similar to historical accounts, native cyprinids (Mexican stoneroller *Campostoma ornatum*, Mexican roundtail chub *Gila minacae*, ornate minnow *Codoma ornata*) and a single catostomid, Yaqui sucker *Catostomus bernardini* were abundant and widespread. We also collected 16 specimens of catfish from three Rio Tutuaca localities, with identification tentatively confirmed as Yaqui catfish *Ictaluras pricei* (ongoing taxonomic work by A. Varela Romero). Trout *Oncorhynchus* sp. were sampled in three tributary arroyos and specimens are under evaluation by Francisco Garcia de Leon, CIBNOR, La Paz, for verification of tentative identification as Yaqui trout *Oncorhynchus* sp. The presence of a fish fauna consisting of only native species is an increasing rarity in the Sierra Madre and deserves management emphasis. Discussion by co-authors with local officials in Tutuaca and Chihuahua indicated that fish farming with nonnative fishes is absent from the upper Rio Tutuaca. Thus, the opportunity exists to preserve an intact native fish community through cooperation with rural development programs to avoid nonnative species propagation, currently a widespread hybridization threat to native Mexican catfishes and trouts.

15:15 **Bonneville Basin Area Report**

Wilson, Krissy W.*[1]; Miller, Peggy A.[1]. (1-Utah Division Wildlife Resources).

We present a brief summary of activities for this year associated with native aquatic species in the Bonneville Basin. The Rangewide Agreement and Strategy for Three Fish Species and the Conservation and Management Plan for Three Fish Species in Utah, addressing needs for Roundtail Chub, *Gila robusta*, Bluehead Sucker, *Catostomus discobolus*, and Flannelmouth Sucker, *Catostomus latipinnis*, were finalized. Genetic analyses for bluehead sucker, with emphasis on drainages in Utah, were completed. A refuge population for least chub, *Iotichthys phlegethontis*, was established in the Walt

Fitzgerald Wildlife Management Area; Utah Division of Wildlife Resources owned property. An additional refuge population for least chub is being raised onsite at the Fish Springs National Wildlife Refuge, in the West Desert, with plans for introduction as young are produced. A Conservation Easement is near completion for important least chub and Columbia spotted frog, *Rana luteiventris*, habitat in the West Desert. The June Sucker, *Chasmistes liorus*, Recovery Program continues to be very active. Red Butte Reservoir has been designated as the location for the primary refuge population. June suckers were introduced into Red Butte Reservoir late fall. The Bonneville cutthroat trout, *Oncorhynchus clarkii utah*, program has finalized the tri-state conservation agreement. A conservation easement was finalized for Columbia spotted frog along the upper Provo River. The developer donated approximately 600 acres of occupied riverine and wetland habitat with a value of 10 million dollars.

15:30 **Population genetics and conservation of chubs from Arizona**

Schwemm, Michael R.*[1]; Dowling, Thomas E.[1]. (1-Arizona State University, School of Life Sciences, Tempe, Arizona 85287).

Mitochondrial (ND2) and nuclear (Tpi-B, S7) DNA sequences were used to investigate the relative influence of species morphology, geographic isolation, and recent hybridization on patterns of genetic variation in endangered chubs of the lower Colorado River basin (*Gila robusta, G. nigra, G. intermedia*). Overall, genetic variability was low across all populations. Molecular results from a combination of analyses (e.g., Analysis of Molecular Variance, Nested Clade Analysis) indicate variation was not partitioned according to species morphology or hydrography. Instead, many populations of all three species showed diagnostic differences in terms of allele fixation or frequency differences. The complicated history of these three species reflects patterns of connectivity and fragmentation at historic and recent temporal scales. This presents a challenge to taxonomy and traditional management practices. In order to account for both morphology and molecular variation, we suggest a management system that first retains morphological variation and then further subdivides these groups by molecular variation. Management objectives must strive to maintain individuality of distinct subpopulations under a single management plan that considers the entire species complex.

15:45 **Update on Lake Mead razorback sucker research, evidence of recent recruitment, and lessons learned from Lake Mead razorback suckers regarding species recovery**

Albrecht, Brandon*[1]; Holden, Paul[1]. (1-BIO-WEST, 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 the past 10 years. Major emphasis of this research has been to locate spawning sites at these two areas and to use aging information to identify patterns of recruitment for both populations. Using multiple methodologies (trammel netting for adults, larval sampling, and telemetric data from captive-reared sonic-tagged fish) a new spawning area was located at the Fish Island area in the Overton Arm of Lake Mead, a highlight of the 2004-2005 and 2005-2006 field seasons. In addition, the first known shift in the spawning habitat selection of the Las Vegas Bay population was documented in 2006.

Since the early years of our research on Lake Mead, fin-ray aging data and back-calculation techniques have indicated that recruitment of razorback sucker on Lake Mead has occurred nearly every year. Known numbers of fish recruited to the population range from a single, individual recruit per year (typically spawned during low water years) to over 10 individual recruits per year (generally associated with relatively high water years). Recruitment has been documented to have occurred as recently as 2002. The continued presence of actual, wild recruitment in the form of young, sexually immature individuals makes the Lake Mead razorback sucker population a rarity and an anomaly in terms of razorback sucker persistence throughout the Colorado River drainage, despite similar non-native fish composition and densities as other locations. As time passes and monitoring efforts continue, we would expect to begin capturing a low number of individuals spawned during 2003, 2004, 2005, and even 2006. If/when the lake rises substantially in future years, we would expect to see another pulse in recruitment. Continued efforts on Lake Mead should help to ascertain if in fact recruitment events continue, and perhaps begin to understand more fully how to enable this unique trend in other locations.

We hypothesize that the limited recruitment seen in the two small Lake Mead populations is the result of large amounts of inundated vegetation, created by long-term lake level fluctuations, along with turbidity in several key areas of the Lake. Even though lake level fluctuations affect the entire lake, and razorback sucker once spawned in many locations throughout Lake Mead, recruitment has occurred at only two or three locations. We believe vegetation and turbidity provides increased protective cover for larval and juvenile razorback sucker, allowing them to avoid predation by large numbers of nonnative sport fish present in the system. Interestingly, these factors are only found in relatively few and/or small locations in the lake.

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

We suggest that Lake Mead is providing us an example of what naturally recruiting razorback sucker populations may look like in the real world of nonnative predators. Small areas that provide the components for recruitment may well be an alternative “recovery solution” rather than large populations that rely on large sections of river or reservoir habitat that requires intensive management to achieve minimal recruitment. If small populations are a potential recovery tool and are considered important, we need to begin understanding how to form the nuclei of small populations in locations with suitable recruitment habitat. Ideas regarding potential avenues of experimentation and concepts of how to initiate new populations will be discussed using a potential site location, Driftwood Cove, as an example from Lake Mead.

16:00 **Recent trends in Grand Canyon humpback chub *Gila cypha* population suggest stabilization**

Andersen, Matthew E.*[1]; Coggins, Lewis G. Jr.[1]; Gwinn, Daniel C.[1]. (1-U.S. Geological Survey, Grand Canyon Monitoring and Research Center).

The population of adult (> 4 years old) Humpback Chub *Gila cypha* in the Colorado River system in Grand Canyon, Arizona likely numbered more than 10,000 individuals at the end of the 1980s. Based on continuous monitoring of the population (more than 80% of the population has a PIT tag) it appears to have entered into a steep decline at the end of the 1980s. By 2002 researchers concluded that the population had dropped below 4,000 individuals and was continuing to decline. Utilizing data collected in 2003, 2004, and 2005, researchers now conclude that the population appears to have been stabilizing at about 5,000 individuals since 2000. The Age-Structured Mark Recapture (ASMR) open population estimator model being used in Grand Canyon is very sensitive to new information, as these results indicate. ASMR also allows for relatively rapid assessment of freshly available information. Researchers cannot be certain why the Grand Canyon population may have stabilized, but hypothesize that one or more of the following may have contributed: 1. Nonnative fishes, primarily rainbow trout, were removed in the Colorado River near the Little Colorado River, where humpback chub spawn, from 2003 to 2006, 2. Experimental releases from Glen Canyon Dam, including low flows in the summer of 2000 that may have increased humpback chub survival and some variable flows since that time that may have reduced rainbow trout recruitment, and 3. Increased mainstem water temperatures released from Glen Canyon Dam as a result of ongoing drought. Increased mainstem temperatures may have increased survival and recruitment of humpback chub. Researchers will alter their sampling schedule slightly in 2007 and 2008 in order to conduct concurrent estimates of the humpback chub population in the Little Colorado and Colorado rivers, but generally must be cautious of sampling design changes in order to minimize assessment errors resulting from confounding parameters.

16:15 **Fish surveys in the Verde River and Horseshoe reservoir during maximum and minimum reservoir levels**

Robinson, Anthony T.*[1]. (1-Arizona Game and Fish Department).

Horseshoe Reservoir is an irrigation storage reservoir on the Verde River operated by Salt River Project (SRP). Because Colorado pikeminnow, *Ptychocheilus lucius*, and razorback sucker, *Xyrauchen texanus*, are occasionally found in the Verde River immediately upstream, SRP wants to operate the reservoir to disadvantage sport fish. To provide SRP with information to help decide which storage regime would best benefit native fish species, Arizona Game and Fish Department Research Branch conducted fish surveys during spring and autumn in the lower Verde River immediately above Horseshoe Reservoir, and in Horseshoe Reservoir itself during 2005 when the reservoir filled, and during 2006, when the reservoir remained mostly at minimum pool to attempt to determine if species composition, relative abundance, and recruitment to the adult population of nonnative fishes differed between the two years. During spring 2005, when the reservoir was near full pool, we captured mostly common carp, *Cyprinus carpio* (87% of catch), a few sport fish (9% of catch), and seven razorback suckers (1% of catch). The razorback suckers were all tuberculate males and were captured in one gill net, set in the upper Verde River arm of the reservoir. No native fishes were captured in either the

Verde River (dominated by red shiners, *Cyprinella lutrensis*—72%) or Horseshoe Reservoir (dominated by common carp--52% and goldfish, *Carassius auratus*,--42% of catch) during autumn 2005 when the reservoir had been drained to near minimum pool. During spring 2006, when the reservoir was still near minimum pool, red shiner again dominated the catch (70%) in the Verde River, and common carp (36%) and goldfish, (56%), dominated the catch in Horseshoe Reservoir, but two razorback suckers, and one Sonoran sucker, *Catostomus insignis*, were also captured. One of the razorback suckers was stocked in 2003, the other in either 2002 or 2005, as indicated by location of coded wire tags. Capture of razorback suckers in the reservoir indicates that they are persisting in the system for at least a few years. Common carp and goldfish are recruiting (based on size structure) in Horseshoe Reservoir, but recruitment of sport fish appears to be minimal. The current operating regime may indeed be negatively impacting nonnative sport fish, but common carp and gold fish are thriving, and these two species likely compete with and prey on early life stages of native fishes.

16:30 **Potential impacts of mainstem and tributary diversions on three fish species in two southeastern Utah streams**

Walker, Craig A.*[1]. (1-Utah Division of Wildlife Resources).

Agricultural and municipal demands for water are increasing in the Intermountain West. Water improvement projects (e.g., dams and diversions) associated with these demands have resulted in the fragmentation of lotic systems throughout this region. During the 2003 – 2005 period, Utah Division of Wildlife Resources (UDWR) personnel conducted surveys to determine the current distribution of roundtail chub *Gila robusta*, bluehead sucker *Catostomus discobolus*, and flannelmouth sucker *Catostomus latipinnis* (three species) in several drainages in southeastern Utah. The results of these surveys, when compared to historical distribution information, revealed an apparent constriction of three species' tributary use in Utah. It is likely that such a constriction is due, in part, to habitat loss and fragmentation and the resultant restriction of seasonal three species' movements. Recent research in the Intermountain West indicates that some of the three species may be phylopatric to natal streams. If site fidelity is a life history strategy of three species populations, the impacts of tributary habitat losses may be greater than previously suspected. The possibility that water development for agricultural and municipal use is a serious threat to the persistence of three species populations needs to be investigated and, if necessary, addressed. Genetic research and movement studies are needed to examine connectivity among three species populations and improve our knowledge of the life histories of these fishes. Greater knowledge of the life histories of these species will enhance the effectiveness of future conservation efforts. Although these efforts may be controversial among local residents and governments in the short term, they would be consistent with the proactive goals and objectives outlined by UDWR in the Conservation and Management Plan for Three Fish Species in Utah and should be pursued. Additionally, local residents and governments who cooperate with UDWR in an effort to reduce threats to the three species would realize an important long term benefit of conservation, namely the ability to maintain the levels of land use and recreational activity they currently enjoy.

16:45 **Desert Fish Habitat Partnership: an emerging partnership under the National Fish Habitat Action Plan**

Gardner, Eric[1]; Propst, David[2]; Sjoberg, Jon[3]; Fowler-Propst, Jennifer[4]; Kosa, Jarrad[5]; Boyer, Kathryn[6]; Beard, Douglas[7]; Allan, Nathan*[8]. (1-Arizona Game and Fish Department; 2-New Mexico Department of Game and Fish; 3-Nevada Department of Wildlife; 4-U.S. Fish and Wildlife Service; 5-Bureau of Land Management; 6-Natural Resources Conservation Service; 7-U.S. Geological Survey; 8-Desert Fishes Council).

The National Fish Habitat Action Plan (NFHAP) is a new initiative designed to protect, restore and enhance the Nation's aquatic communities through partnerships that foster fish habitat conservation and improve the quality of life for the American people. The Desert Fish Habitat Partnership (DFHP) is being developed by regional partners with a common interest in promoting voluntary, non-litigious, non-regulatory, success-oriented desert fish habitat conservation. It is the intention of the partners to seek national recognition for DFHP as a partnership operating under the auspices of the NFHAP. Many state and Federal agencies and conservation organizations are engaged in positive, on-the-ground activities and strategies to conserve desert fish habitat – this effort will build on these conservation successes. The DFHP will help focus resources on aquatic habitats where the highest priority ecological restoration needs can largely be identified through existing state-based planning efforts and available science assessments. Activity will be centered on key habitats, imperiled species, geographic areas and on proven high-benefit conservation actions.

18:30 - 22:00 EVENING DISCUSSION SESSION - Desert Fish Habitat Partnership

Location: Oasis Room at Furnace Creek Inn, located up on the hill to the east of Furnace Creek Ranch and the Visitor Center.

Friday, 17 Nov. 2006

08:30 - 12:00 GENERAL SESSION - 3
Location: Visitor Center Auditorium.

08:30 **Recent records of the genus *Cycleptus* in the Conchos River, Chihuahua, México**
Lozano-Vilano, Maria de Lourdes*[1]. (1-Universidad Autónoma de Nuevo León, F.C.B.).

The genus *Cycleptus* is widely distributed in the Atlantic region of the southern United States, principally in the Mississippi, Missouri and Ohio Rivers to the North of México in the Río Grande - Río Bravo. There are few records from México, with the most recent from 1977. Two Mexican records are from the Río Conchos, two are from the Río Grande - Río Bravo, and one is from the Río San Juan. In 1954, *Cycleptus* was reported from two localities in the Río Conchos, one mile north of Saucillo and one kilometer above the mouth of the Río Grande (collected by C. Hubbs and V. Springer). After 51 years with no report of *Cycleptus* in this area, it was rediscovered in two localities: La Boca del Río Conchos Río Bravo and Cuchillo parado. We are studying the taxonomic status of the species, as is presumably a new one.

El género Cycleptus se encuentra distribuido hacia el Atlántico Sur de Estado Unidos, principalmente en los Ríos Mississippi, Missouri y Ohio hasta el Norte de México en el Río Grande-Río Bravo. Los registros para México son pocos y el más reciente data de 1977; entre estos 2 son para el Río Conchos, dos para el río Grande- Río Bravo y otro mas en el Río San Juan. En 1954 en el Río Conchos se reporto la presencia de Cycleptus en dos localidades, una en: 1 mi N Saucillo y la otra a 1 Km. Arriba de la boca del Río Grande, fueron colectados por Hubbs, C. y V. Springer. Después de 51 años de no ser visto este Género para el área fue redescubierta su presencia en dos localidades: En la Boca del Río Conchos Río Bravo y Cuchillo parado. Actualmente estamos estudiando el estatus de la especie, ya que presumiblemente es nueva.

08:45 **Status of the desert pupfish *Cyprinodon macularius* in California**
Keeney, Sharon D.*[1]. (1-California Department of Fish and Game).

California Department of Fish and Game (Department) is monitoring the status of desert pupfish *Cyprinodon macularius* populations in and around the Salton Sea (Sea) in Riverside and Imperial counties. Since March 2003, the Department has been conducting monthly minnow trapping surveys in selected irrigation drains emptying into the Sea, in two shoreline pools of the Sea and in the Sea proper. In May and June of 2006, the Department conducted minnow trapping surveys in tributary streams and refugia. From March, 2003 through February, 2006, desert pupfish catch-per-unit-effort (CPUE) ranged from 0.03 to 5.78 fish per trap-hour in the irrigation drains, was 3.61 fish per trap-hour in the shoreline pools and was 0.12 fish per trap-hour in the Sea proper. Desert pupfish CPUE was 16.7 fish per trap-hour in San Felipe Creek, 0.17 fish per trap-hour in upper Salt Creek and 0.20 fish per trap-hour in lower Salt Creek. Desert pupfish CPUE in refugia varied from 0.00 to 30.0 fish per trap-hour. Current threats to pupfish populations include non-native species, invasive vegetation and various water quality issues. The Resources Agency (Agency) is working on an ecoystem restoration plan for the Sea. The

Agency has identified eight alternatives and is evaluating a No Action Alternative based on a range of inflows. The preferred alternative will be submitted to the legislature by December 31, 2006.

09:00 **Removing exotic fish species from large spring systems, Big Warm Springs, Duckwater Valley, Nevada**

Heinrich, James E.*[1]; Hobbs, Brian[1]; Nielsen, Bridget[2]. (1-Nevada Department of Wildlife, Southern Region, Las Vegas, Nevada; 2-United States Fish and Wildlife Service, Reno, Nevada).

Invasive aquatic species, once established in springhead and spring pool environments often seal the fate of endemic species in the system. Due to the complete dominance of these invasive species and the complicated nature of springhead habitats, removal or eradication efforts are often thought to be too risky or too daunting to undertake. We would like to show that with effective planning and extensive system reconnaissance, even large-scale springheads and outflows can be renovated and invasive species removed. Big Warm Spring, in Duckwater Valley, Nevada, once contained large numbers of native Railroad Valley springfish, *Crenichthys nevadae,* but aquarium fish releases, and commercial channel catfish producers introduced 3 species of invasive fish that eventually decimated the springfish population. Encouraged by the Duckwater Shoshone Tribe (Tribe), the U.S. Fish and Wildlife Service and Nevada Department Of Wildlife renovated a 16 cfs spring system and 1900 meters of stream outflow. A January 2006 channel reconstruction and two days of rotenone treatments, appear to have successfully removed two of the three invasive fish species from this system. To accomplish this goal the Tribe and the Service reached an agreement to ultimately preserve the Tribe’s economic goals and water rights, and benefit both the springfish and people.

09:15 **John Otterbein Snyder, explorer of western fishes**

Brittan, Martin R. Dr.*[1]; Jennings, Mark R. Dr.[2]. (1-California State University, Sacramento, CA, Department of Biological Sciences, Emeritus.; 2-President, Rana Resources, Davis, CA.).

John Otterbein Snyder was a young undergraduate who followed his mentors, David Starr Jordan and Charles Henry Gilbert, from Indiana University to the new Stanford University in California in 1891. Jordan became Stanford's first president and Gilbert the first head of its Zoology Department. Snyder graduated with an A.B. in 1897 and was awarded the M.A. in 1899.

Jordan had been an inveterate organizer of expeditions at Butler and Indiana Universities, long before coming to Stanford, with Gilbert, Barton Warren Evermann, Seth Eugene Meek, and Carl Eigenmann participating. In 1896-7, Jordan took young Snyder with him to collect in central Mexico, and in 1900 to the Hawaiian Islands and Japan. The two, with Japanese help, made very large collections. In 1902, began the first of many trips made by Stanford ichthyologists on the U.S. Fish Commission's *Albatross* to the Hawaiian and Laysan Islands, resulting in 210 new species (!), later described by Gilbert. In 1906, the ship visited Japan, the Ryukyus, Kamchatka, and the Aleutians, with Gilbert, Snyder, and Walter K. Fisher on board.

In 1904, Snyder and Edwin Chapin Starks made a long trip by horse and wagon to the lakes of n. e. California and s. e. Oregon, beginning Snyder's studies of western fishes. Gilbert, Snyder, and Starks surveyed the fishes of the streams tributary to Monterey Bay in 1909, and in 1911 Snyder and Charles H. Richardson collected in the Lahontan Basin of Nevada and n. e. California.. Snyder and Carl Leavitt Hubbs studied the cutthroat trout of the Truckee River and Pyramid Lake in 1915 and 1916. Snyder and Hubbs made a strenuous collecting trip through the Bonneville Basin of Utah and Idaho in 1919. Hubbs called it “a trip into hell.” In following years, Snyder investigated streams tributary to San Francisco and Tomales Bay, of the coasts of northern California and Oregon, the Owens and Mojave Rivers, Lake Tahoe, and the San Pedro Martir mountains of northern Baja California.

From 1900 to 1909, Snyder was junior author to Jordan in a series of reviews of fish families of Japan (about 35, with 6 by Snyder alone), finishing with the 497 page *Catalogue of the Fishes of Japan,* by Jordan, Shigeho Tanaka, and Snyder. Snyder also did papers on fishes of Formosa (Taiwan) and Okinawa.

Between 1921 and 1931, Snyder investigated the California salmon and steelhead fisheries, particularly in the Klamath and Trinity Rivers, resulting in the 130-page California Fish and Game Fish Bulletin 34, *“Salmon of the Klamath River, California,”* detailing life history , transplant and homing experiments, and declining catches, which Snyder concluded were due to gill netting, bringing too many small fish to market, and the inadequacy of hatcheries in making up for overfishing. This established Snyder as a leading western fisheries biologist.

Snyder had 107 publications. Named for him are three genera or subgenera (*Snyderichthys, Snyderidia, and Snyderina,* all valid) and 19 species or subspecies (17 remaining valid; familiar are *Catostomus snyderi, Dialarchus snyderi, Gila bicolor snyderi., Oligocottus snyderi, and Prosopium snyderi).* Jordan and Snyder together described about 65 new species, Snyder with others about a dozen, and Snyder alone about 25. He was involved in the description of 25 new genera. Snyder had 12 graduate degree students, all between 1923 and 1934, 8 for the M.A.(Heraclio Montalban, Donald Fry, Chi-Jung Lo, George H. Clark, Joseph A. Craig, George Sprague Myers, Eugene C. Scofield, and Alan Taft) and 4 for the Ph.D.(Deogracias Villadolid, George A. Rounsefell, William Francis Thompson, and Rolf L. Bolin). Three of the M.A.' s later earned Ph.D.'s, Myers and Taft under Willis Rich, and Craig under Myers). It should be noted that in the earlier decades Gilbert had most of the advanced degree students (16), and that Stanford was a small, but academically elite, school with never more than 2,500 students. After WW2, Myers, Bolin, and Rich benefited from the burgeoning number of students flocking back to college (with 49, 22, and 18 advanced degrees, respectively).

Snyder took over as head of the Zoology Department in 1925, when Gilbert retired. Snyder himself retired in 1931, becoming Chief of the Bureau of Fish Propagation, later the Bureau of Fish Conservation,, of the California Division of Fish and Game. He retired because of ill health in 1937, and died in 1943.

In addition to his long tenure at Stanford, where he was part of the renowned “Stanford School of Ichthyology,” and his work with the U. S. Fish Commission and the California Division (now Department) of Fish and Game), Snyder was also variously Expert Ichthyologist for the U.S. National Museum, Director of the U.S. Bureau of Fisheries Laboratory at Woods Hole, and a member of the Palo Alto City Council for 5 years. He was also a fine field ornithologist. He and Starks were joined by several

students in saving part of the large Stanford fish collections sent crashing to the floor in the April, 1906, earthquake, spraying them with hoses so they would not dry out, and then sorting them, and rebottling and relabeling.

The senior author was a Ph.D.student of George S. Myers (Clark Hubbs had the adjacent cubicle), and took courses from Willis Rich and Rolf Bolin, and knew well ichthyologists Carl Hubbs and A.W.C.T. Herre, and fisheries biologists Bill Dill, Don Fry, and Joe Wales, and less well, Dick Croker, Oscar Sette, Alan Taft, Lionel Walford, and Frank Weymouth, all products of the "Stanford School." At meetings of the Myers-Rich Stanford "Fischverein," where many of the old-timers were frequent visitors, my fellow grad students and I sat in on many of the fascinating and constructive "bull sessions." The memories of the grand master Jordan and the dignified, intellectually-demanding Gilbert hovered in the background, and the shy but dedicated Starks, and the friendly and dedicated Snyder, were closer in memory. The words we heard of Snyder were, "A sound and stimulating teacher and scientist" and "A fine man." A great tribute, indeed!

09:30 **The effects of temperature on the interaction between least chub, *Iotichthys phlegethontis,* and western mosquitofish, *Gambusia affinis*: do mosquitofish have an "Achilles Heel"?**

Priddis, Edmund R*[1]; Rader, Russell B[1]; Belk, Mark C[1]. (1-Brigham Young University, Department of Integrative Biology).

The decline of native least chub, *Iotichthys phlegethontis*, in the Bonneville Basin of Utah has been attributed to habitat degradation and harmful interactions with introduced western mosquitofish, *Gambusia affinis*. We have previously shown that mosquitofish prey on juveniles and aggressively displace both juvenile and adult least chub. Also, adult mosquitofish overlap in habitat use with juvenile least chub during spring spawning activities. We will report on two experiments testing the hypothesis that cool temperatures will reduce the harmful impact of mosquitofish on least chub. The first is a long-term population growth study with ten least chub (5 males and 5 females) in each of twenty tanks, half with warm temperatures (15° C to 30° C) and half with cool temperatures (0° C to 15° C). Ten mosquitofish (5 males and 5 females) were added to half of the warm treatment tanks (5 tanks) and half of the cool treatment tanks. This study began in the Spring of 2006 and will run through the Autumn of 2007, which includes one winter and two least chub spawning periods. Preliminary data shows that the warm treatment contains abundant mosquitofish (100s) and no juvenile least chub, whereas mosquitofish have failed to reproduce in the cool treatment. However, the cool treatment contains a healthy population of least chub with several young-of-the-year in each tank. The second experiment tested the hypothesis that cool temperatures would reduce mosquitofish predation on least chub. Four small least chub (11mm-14mm) and four large female mosquitofish (starved for 24 hrs) were placed in four 5-gallon aquaria, and one of four temperatures (10° C, 15° C, 20° C, and 25° C) was randomly assigned to each aquarium. The response variable was time to when half of the least chub were eaten. Time to LD-50 shows a linear relationship with temperature requiring 1-2 hours at 25º C, 12-13 hours at 20º C, 35+ hours at 15º C, and 44+ hours at 10º C. These results indicate that temperatures of 15º C and cooler will diminish the harmful effects of mosquitofish

on least chub. Temperature may be the best means whereby native least chub can coexist with mosquitofish.

09:45 **Northwestern Mexico Area Report: recent studies on fishes in Northwestern Mexico**
Ruiz-Campos, Gorgonio*[1]; Varela-Romero, Alejandro[2]; Camarena-Rosales, Faustino[1]; Duncan, Doug[3]; Reyes-Valdez, Claudia A.[1]; Acosta-Zamorano, Dinora[1]; Alaníz-García, Jorge[1]. (1-Universidad Autónoma de Baja California, Facultad de Ciencias, Ensenada; 2-Universidad de Sonora, DICTUS, Hermosillo; 3-201 N. Bonita, Suite 141, Tucson, AZ 85745).

This report provides information of different studies on fishes performed in the Mexican states of Baja California, Baja California Sur, Sonora, Durango and Chihuahua. The abundance of the Desert pupfish *Cyprinodon macularius* was monitored in the only remnant population in Baja California (Cerro Prieto Geothermal ponds) by bimonthly samplings from August 2005 to August 2006. This population is still abundant and exhibits seasonal fluctuation in abundance caused by the dynamics of water levels that determine the availability of marginal habitats for colonization and dispersion among ponds. The diet composition of 14 native trout populations of the genus *Oncorhynchus* from the Sierra Madre Occidental in the states of Sonora, Durango and Chihuahua was analysed. High percentages of terrestrial insects were found in all the groups of trout studied. The most important food items for the "northern rainbow trout" (Rio Mayo and Rio Yaqui) were Tabanidae (Diptera) and Acrididae (Orthoptera); "Mexican golden trout" (Rio Fuerte, Rio Sinaloa and Rio Culiacan), Formicidae and Vespoidea (Hymenoptera); and "southern rainbow trout" (Rio San Lorenzo, Rio Piaxtla, Rio Presidio, Rio Baluarte and Rio Acaponeta), Formicidae, Vespoidea, and Leptophlebiidae. The diet of Baja California killifish, *Fundulus lima*, was studied in different sites of the hydrological basins of Rio San Ignacio and Rio La Purísima, Baja California Sur. The killifish of the Río San Ignacio had high percentages of sand (39%), dipteran larvae (19%)and filamentous algae (17%); whereas that those of the Río La Purísima also had high percentages of sand (47%), dipteran larvae (19%), trichopteran larvae (16%) and filamentous algae (12%). Finally, we present information on recent fish samplings (2006) in the San Pedro, Cocospera and Santa Cruz rivers, in Sonora.

10:00 **Upper Colorado River Basin Area Report**
Christopherson, Kevin D.*[1]. (1-Utah Division of Wildlife Resources).

Fish recovery efforts continue on several fronts in the Upper Colorado River Basin. The Upper Colorado River Basin Recovery Program coordinates the largest effort, which included monitoring, stocking, non-native fish removal, and limited research. Efforts to expand the Colorado River Cutthroat range are advancing. Utah has completed its three species conservation plan, and the Colorado and Wyoming plans are near completion.

10:15 **Effects of significant flooding on Aravaipa native and non-native fish communities**
Reinthal, Peter N.*[1]; Blasius, Heidi[2]; Haberstitch, Mark[3]. (1-Dept. Ecology and Evolutionary Biology, Univ. Arizona, Tucson; 2-BLM, Safford AZ; 3-The Nature Conservancy, Klondyke AZ).

We report on recent faunal surveys in Aravaipa Creek AZ following major 100 year floods during 2006 and discuss flood effects on the fish community, including native and non-native fishes.

10:30 **Mitochondrial and morphological advances in knowledge of northern Mexico's native catfishes *Ictalurus* (Pisces: Ictaluridae)**

Varela-Romero, Alejandro*[1]; Yepiz-Plascencia, Gloria; Hendrickson, Dean A.. (1-Department of Scientiphical and Technological Research, University of Sonora; 2-Aquatic Molecular Biology Laboratory, CIAD; 3-Texas Natural Science Center, University of Texas at Austin).

Species of the genus *Ictalurus* are among the most abundant and commonly encountered members of the family Ictaluridae, which ranges from southern Canada to southern Mexico and Central America. The genus is comprised of two clades; the *furcatus* clade containing the species *furcatus, meridionalis* and *balsanus*, while the *punctatus* clade includes *punctatus*, *lupus*, *australis*, *dugesi*, *mexicanus* and *pricei*. The majority of the diversity in the genus clearly resides in Mexico, yet Mexican species are very little studied and a number of forms remain undescribed. Some undescribed taxa are members of what has been referred to as the poorly known "*Ictalurus pricei* complex". Our work reveals at least two distinct, undescribed forms from the Fuerte, Culiacan and San Lorenzo river basins. Phylogenetic relationships of these and many other native catfishes from North and Northwest Mexico were estimated by analysis of complete sequences of the mitochondrial genes *12SrRNA* (954 bp) and *Cytb* (1138 bp). Both mitochondrial genes have fixed inter-specific differences and high levels of intra-specific variation was found among individuals from the Yaqui, Fuerte, Culiacan, San Lorenzo, Conchos, and Cuatro Cienegas basins. Maximum parsimony and maximum likelihood analysis of each gene separately and both genes together support monophyly of both the *punctatus* and *furcatus* clades. Relationships derived from only *Cytb* exclude specimens from the Fuerte, Culiacán, and San Lorenzo Rivers from the *price* clade, grouping them instead with specimens from the Conchos basin and *lupus* from Northeastern Mexico, and other native catfishes of Northwest Mexico. Traditional morphological characters tend to agree with the molecular data but do not provide useful diagnostic characters for all new taxa. A search for new diagnostic characters has been initiated to help workers make specific determinations on the basis of morphology, but hybridization with widely introduced *I. punctatus* is recognized as a confounding factor for both molecular and morphological analyses.

Avances en el conocimiento mitochondrial y morfológico en bagres nativos *Ictalurus* (Pisces: Ictaluridae) del norte de México

Las especies del género*Ictalurus* están entre los miembros de la familia Ictaluridae más abundante y comunmente encontradas y se distribuyen desde el sur de Canadá hasta el sur de México y Centro América. El género esta compuesto por dos clados: el clado *furcatus* que contiene a las especies *furcatus, meridionalis* y *balsanus*; y el clado *punctatus* que incluye a las especies *punctatus, lupus, australis, dugesi*, *mexicanus* y *pricei*. La mayor parte de la diversidad del género radica en México y aunque las especies Mexicanas están poco estudiadas, un número desconocido de formas permanecen aún sin

descibirse. Algunos taxa no descritos son miembros de lo que se ha referido como el poco conocido "complejo *Ictalurus pricei*". Nuestro trabajo revela al menos dos formas no descritas distintas para la cuenca del Río Fuerte y las cuencas de los ríos Culiacán y San Lorenzo. Las relaciones filogenéticas de estos y otros bagres nativos del Norte y Noroeste de México fueron estimadas por el análisis de secuencias completas de los genes mitocondriales *12SrRNA* (954 bp) y *Cytb* (1138 bp). Ambos genes mitocondriales definen diferencias interespecíficas y se encontraron altos niveles de variación intraespecífica entre los individuos de las cuencas del Yaqui, Fuerte, Culiacán, San Lorenzo, Conchos, y Cuatro Cienegas. Los análisis de máxima parsimonia y máxima verosimilitud de cada gen por separado y ambos genes juntos soportan la monofilia de los clados *punctatus* y *furcatus*. Las relaciones derivadas de sólo el *Cytb* excluye los especimenes de los ríos Fuerte, Culiacán y San Lorenzo del clado *price*, agrupándolos con los especimenes de la cuenca del Conchos y *lupus* del Noreste de México y con otros bagres nativos del Noroeste de México. Los caracteres morfológicos tradicionales tienden a concordar con los datos moleculares pero no proveen aún caracteres diagnósticos útiles para los nuevos taxa. Se ha iniciado una búsqueda de nuevos caracteres diagnósticos para apoyar a los ictiólogos en las determinaciones basadas en la morfología, pero se reconoce a la hibridización con el ampliamente introducido *I. punctatus* como un factor de confusión en los análisis molecular y morfológico.

10:45 **Patterns of macroinvertebrate and metaphyton diversity in desert wetlands of the Bonneville Basin, Utah**

Keleher, M. Jane*[1]; Rader, Russell B. (1-Brigham Young University, Department of Integrative Biology and Salt Lake Community College, Division of Natural Sciences; 2-Brigham Young University, Department of Integrative Biology).

Desert artesian springs are one of the most threatened natural systems in the world because they supply water, the primary limiting resource for arid environments. They are also diversity hotspots in the desert landscape of the Bonneville Basin (Basin) ranging in size from small individual springs (< 1.0 m²) to large spring complexes (> 600 km²) that are scattered along the base of the mountains and throughout the valley floors in the Basin. Several aquatic taxa occur within these wetlands as relict populations since Lake Bonneville receded more than 14,000 years ago (e.g. least chub, *Iotichthys phlegethontis*). Although some of these relict populations have been studied extensively, the species composition and diversity of most aquatic taxa have been poorly documented. Because of the threatened condition of these springs, the primary purpose of this study was to describe the physico-chemical environment and patterns of macroinvertebrate and metaphyton diversity in wetlands of the Bonneville Basin. Included in this analysis was an examination of patterns of diversity across multiple scales. Multi-scale studies are important because 1) patterns can change with changes in scale (e.g. local, valley, regional) and 2) management objectives may require an understanding of human effects on biodiversity at different scales. For example, the effects of grazing or invasive species on diversity may be best managed at the local scale (e.g. marshes and springs), whereas the effects of road density or urbanization may be best managed at the valley or regional scale. We separated our description of both groups (macroinvertebrates and metaphyton) into three scales: valleys nested in the Bonneville Basin, wetland types nested in valleys (isolated and complexes), and habitat types nested in wetlands (springs, channels, and marshes). Using standard data collection methods, we

collected a total of 544 different invertebrate and metaphyton taxa at 280 sites throughout the Basin. There undoubtedly exist many more species that we did not encounter especially, algal species because we only sampled a single microhabitat (metaphyton); however, our sampling scheme was sufficient to show intriguing patterns of diversity at different scales for both groups. For example, when macroinvertebrate and metaphyton richness was accumulated for each habitat type across the entire basin and adjusted for differences in sampling effort both showed a similar pattern; channels and springs contained more species than marshes. However, the average within-site richness of habitats for both invertebrates and metaphyton showed the opposite pattern. Marshes contained more species than channels or springs after accounting for variation attributed to wetland types and valleys. We will present a multitude of additional patterns of diversity that we observed at the local scale as well as at the wetland, valley, and regional scales. We suggest that two environmental characteristics primarily determine these patterns of diversity in springs of the Bonneville Basin, temporal variability and habitat heterogeneity. Another intruiging area we explored using these data was testing predictions of Island Biogeography Theory.

11:00 **Rio Grande silvery minnow nursery habitat: linking geomorphology to essential life history requirements**

Beck, Sarah[1]; Porter, Michael D.*[2]; Massong, Tamara M.[2]. (1-SWCA Environmental Consultants; 2-U.S. Bureau of Reclamation).

The Rio Grande silvery minnow (*Hybognathus amarus*) is an endangered fish species currently found in 170 miles of the Rio Grande in New Mexico. Successful recovery of endangered species depends on identifying the major factors that result in declining populations.

In 2001, Schmidt et al. (Proc. Desert Fishes Council 33:25-46) discussed changes in the fluvial geomorphology of the Rio Grande/Rio Bravo. Recognizing that the decline of the silvery minnow populations trailed the construction of large dams by thirty years suggested that channel geomorphology has a role in silvery minnow ecology. Inundated riparian habitat is important as nursery habitat for other fish species (Reviews in Fisheries Science 12:23–73). Channel incision reduces seasonal inundation of the floodplain in years with below average spring runoff. Recruitment of silvery minnows corresponds to the level of floodplain inundation during spring runoff.

The nursery habitat concept links silvery minnow early life history to changes in river channel morphology and hydrology. Current research examines how nursery habitat features support silvery minnow recruitment. This type of habitat management provides tools to address habitat degradation resulting from regulatory dams and provide cost effective techniques to re-create ecologically important processes that maximize recruitment and population stability for successful recovery of the species.

11:15 **Foraging success of cyprinids along a turbidity gradient**

Remington, Rachael*[1]. (1-University of Oklahoma).

Increases in suspended sediment in clear water environments negatively impact freshwater fishes in various ways, including reduced spawning and foraging success. However, suspended sediment may not be detrimental to all fish species, in particular,

those that live in naturally turbid environments. Today, some drainages with historically high turbidities (e.g., rivers of the Great Plains and Colorado River) tend to be clearer due to sediment trapping by dams and reduced flows. The loss of turbidity and the role it plays in the decline of fishes in these rivers has received little attention. Species within these drainages are hypothesized to have a number of morphological traits that allow them to be successful in turbid environments. These fishes may depend on high levels of suspended sediment for survival (e.g., feeding, reproduction, or protection from sight-feeding predators). I investigated the effects of turbidity on the foraging success of fishes from clear and turbid systems in Oklahoma and Texas. My prediction was that as turbidity increased, feeding success of turbid-water fishes would be constant while clear-water fishes would decrease. Feeding trials were performed in 40 liter fish tanks at the University of Oklahoma Biological Station. Nine cyprinid species were tested for the number of bloodworms consumed in five minutes across five turbid treatments. Turbid-water fishes fed well in all treatments, but clear-water fishes ate significantly less at higher turbidities. These results imply that turbid-water fishes have an advantage in locating food in highly turbid environments. Thus, decreased suspended sediment loads in historically turbid rivers (via dams) may have reduced the foraging advantage of turbid-water fishes and contributed to their decline.

11:30 **Native fish habitat restoration in selected tributaries of the Grand Canyon: a potential recovery effort for native fishes**

Leibfried, William C. Mr*[1]; Hilwig, Kara Ms.[1]. (1-SWCA Environmental Consultants).

Grand Canyon National Park has initiated a project to restore native fish habitat in tributaries of the Colorado River within the Park's boundaries. The removal of non-native fishes from these streams will create the opportunity for native fishes utilize these open habitats. The ultimate goal of this effort is to reduce non-native fish populations from selected streams to restore the habitats and enhance native fish populations. This project will contribute to the protection and enhancement of native Park resources by restoring habitats occupied by non-native species. Native fishes that would benefit from this project include the endangered humpback chub, flannelmouth and bluehead suckers and speckled dace. In 2004 and 2005 four field efforts were conducted to sample fish populations in Shinumo, Tapeats, and Kanab Creeks to determine which streams would be the most feasible for non-native fish removal efforts and native fish restoration. Fish abundance estimates and non-native fish removal data from these efforts were analyzed and Shinumo Creek was selected for further study. Significant declines in rainbow trout abundance and significant increased abundance for speckled dace were observed during our 2005 field efforts. Our results indicate that non-native salmonids can be effectively removed from Shinumo Creek. Due to these efforts, the potential for repatriation of humpback chub into Shinumo Creek is currently under consideration by federal agencies.

11:45 **Backpack shocking and trout removal efficiency in Upper Bright Angel Creek, Grand Canyon**

Hilwig, Kara D.*[1]; Leibfried, William C.[1]; Serrato, Kevin[1]. (1-SWCA Environmental Consultants).

We conducted this study to determine feasibility and effectiveness of removing non-native salmonids using backpack electrofishing units in the upper reaches of Bright Angel Creek. This study addresses the efficacy of the field technique as a management tool for nonnative fish removal. The removal strategy was to move two shocking crews in tandem, one approximately 40-50m behind the lead team, through the site and push fish ahead of the electric field upstream against a hydraulic control or other barrier where they were more easily stunned and netted. Two days of fish capture and marking (adipose fin clip), and two days of recapture and removal were conducted to estimate the trout population size and removal efficiency. All fish captured during this effort were non-native rainbow trout (Oncorhynchus mykiss), brown trout (Salmo trutta), and rainbow/cutthroat hybrids. Using the Chapman-Peterson mark-recapture method to estimate total trout population, we calculated the trout population during the marking event across the entire sampling area (1.7km) to be approximately 547 fish with a 95% confidence range of 457-656. Using the 2-Pass depletion method, we calculated a similar population estimate of 524 fish with a range of 440-609. Using this information, we estimated the removal efficiency range to be 38 - 56% based on the number of fish captured during the removal event using two staggered electrofishing crews. Removal efficiencies were greatest in reaches with flows of approximately 8 cfs. Multiple passes using this configuration may result in a greater reduction of nonnative trout populations. However, total electrofishing time was 13.6 hours expended over four days throughout the 1.7 km sampling area. Thus, the methodology was effective in removing nonnative salmonids from a short reach of Bright Angel Creek; however, the required effort to remove fish from the entire stream may be unfeasible. This method combined with the use of several weirs may be a more feasible approach to reducing trout populations in Bright Angel Creek.

12:00 - 13:30 LUNCH

13:30 - 16:30 GENERAL SESSION - 4
Location: Visitor Center Auditorium.

13:30 **Life history and ecological characteristics of the Santa Ana sucker**
Saiki, Michael K.*[1]; Martin, Barbara A.[1]; Knowles, Glen W.[2]; Tennant, Patrick W.[3]. (1-U.S. Geological Survey, Western Fisheries Research Center; 2-U.S. Fish and Wildlife Service; 3-Southern California Edison).

This study was conducted to document the life history and ecological characteristics of the Santa Ana sucker, *Catostomus santaanae*, within its native range in southern California. Electrofishing surveys were conducted at 3-month intervals from December 1998 to December 1999 at one site on the San Gabriel River and two sites on the Santa Ana River. Suckers were captured in the San Gabriel River (average, 6.6 fish/10-minutes electrofishing) and at an upstream Santa Ana River site (average, 2.3 fish/10-minutes electrofishing) but not at a downstream Santa Ana River site. Length frequency distributions indicated that at least three year classes (modal groups) of suckers were present in the San Gabriel River, whereas one or two year classes were present in the Santa Ana River. Collection of 21-30 mm standard length (SL) juveniles in June in the Santa Ana River and in September in the San Gabriel River indicated that reproduction occurred over several months. In December, Age-0 suckers averaged 36-48 mm SL in the

San Gabriel River and 63-65 mm SL in the Santa Ana River, whereas Age-1 suckers averaged 86 mm SL in the San Gabriel River and 115 mm SL in the Santa Ana River. On average, suckers were in better body condition in the San Gabriel River than in the Santa Ana River. Highest abundance of suckers was associated with relatively pristine environmental conditions (especially low specific conductance) where other native fishes were also common or abundant.

13:45 **Sculpin dispersal and phylogenetics in the interior of Western North America**
Shiozawa, Dennis K. Dr.*[1]; Christensen, Dan Mr.[1]; Evans, R. Paul Dr.[2]; Campbell, Matt Dr.[3]. (1-Brigham Young University, Department of Integrative Biology; 2-Brigham Young University, Department of Integrative Biology; 3-Brigham Young University, Department of Micro and Molecular Biology; 4-Idaho Game and Fish Department, Eagle Fish Genetics Laboratory).

Phylogenetic relationships between and within species of cottids in interior Western North America suggest dispersal through both headwater transfer and higher order river capture events. These events occurred from Pliocene to late Pleistocene times, and in several cases the relative timing of major drainage capture events can be used to infer the dispersal of native cottids. *Cottus beldingii* appears to have originated in the west and to have dispersed to the east, entering the Colorado River Basin through an ancient, likely Pliocene, connection between the Snake River and the Colorado River basins. *Cottus confusus* also has an old origin, but its absence in the Bonneville and Colorado River basins indicates that it may not have invaded the Snake River system until after the capture of the Snake River by the Columbia River in the late Pliocene. Its focus of origin was probably the Columbia River Basin. The western form of *Cottus bairdii* appears to have originated in the Upper Snake River system and from there it dispersed into the lower Snake River and Bonneville Basin. It also entered the Colorado River Basin, likely from the Upper Snake River through a stream capture event. *Cottus bairdii* was the most recent invader of these three species, but another cottid has also invaded the upper Snake River Basin from the Missouri River system. It's distribution, west of the continental divide, may be limited to a just a few low order streams.

14:00 **An assessment of long-term aquatic habitat change and Gila topminnow population trends for Cienega Creek, Pima County, Arizona - CANCELLED**
Simms, Jeffrey R.*[1]; Simms, Karen M.; Duncan, Douglas K.; Bodner, Gita. (1-U.S. Bureau of Land management, Tucson Field Office, Tucson, AZ; 2-U.S. Bureau of Land management, Tucson Field Office, Tucson, AZ; 3-U.S. Fish and Wildlife Service, Ecological Services, Tucson, AZ; 4-The Nature Conservance, Arizona Chapter, Tucson, AZ).

Cienega Creek, Pima County, Arizona, currently supports the largest, most extensive Gila topminnow (*Poeciliopsis occidentalis*) population in the United States. Data was collected for 14 habitat parameters along 10 km of Cienega Creek in 1990 and 4 km in 4 separate reaches in 2000. Notable changes in aquatic habitat include increased overstory canopy, increased pool habitat area, increased instream cover, increased average pool depth and increased maximum pool depth. Topminnow population trend data was also collected over a 17 year period beginning in 1989. The upper half of the creek has shown

a declining trend in topminnow abundance, including the loss of the species at 2 sites, while the lower portion of the creek has shown a relatively stable trend. As a result of Arizona BLM's riparian restoration strategy, a series of livestock exclosures have been constructed since 1990 to improve riparian and aquatic habitat conditions. The results of long-term monitoring indicate that riparian management is a "double edge sword" with both positive and negative consequences for Gila topminnow. The most detrimental aspects of riparian restoration to the Gila topminnow population appear to be heavy shading and large deposits of leaf litter result in anoxic conditions exacerbated by low flow conditions related to a regional drought cycles.

14:15 **Spatiotemporal population patterns of the Pecos bluntnose shiner, 1992-2005**

Hoagstrom, Christopher*[1]; Brooks, James[2]; Davenport, Stephen[2]. (1-Weber State University, Department of Zoology; 2-U.S. Fish and Wildlife Service, New Mexico Fishery Resources Office).

The Pecos bluntnose shiner *Notropis simus pecosensis* is a threatened species that is restricted to 301 river-km of the mainstem Pecos River between two dams in southwestern New Mexico, U.S.A. The river in this reach transitions from a wide (~80 m) channel with a sand-bed upstream to a narrow (< 40 m) channel with a silt-sand-bed downstream. We collected Pecos bluntnose shiners during regular surveys throughout this river reach for fourteen years. Length-class structure varied among years but there was a significant increase in standard length from downstream to upstream in all years. Mean density varied among seven 39-km river sections, with relatively high densities in river sections 2, 3, and 5. Upstream river sections (1 to 3) exhibited significant density variation among years and annual mean density was correlated among river sections 1 through 4. Density in river sections 5 through 7 was lower overall, but fluctuated greatly within and among years. There was no statistical difference in annual mean density among these river sections, due to the high variation. Density in river sections 1 through 4 was lowest at the beginning and end of the study period, presumably due to river intermittence, which is most severe in river sections 2 through 4. However, population declines in all river sections indicate that drought periods negatively impact the entire population. The population of river sections 5 through 7 appears to be sustained by downstream displacement of young-of-year from upstream. Lack of correlation in density between these river sections and upstream river sections is presumably because individuals in sections 5 through 7 rarely (if ever) reach adulthood. Thus, downstream densities are variable because they depend on annual patterns of downstream displacement and are not stabilized by a perennial population.

14:30 **Aspects of the life history of the San Felipe gambusia, *Gambusia clarkhubbsi*: habitat utilization patterns**

Edwards, Robert J.*[1]; Garrett, Gary P.[2]. (1-University of Texas-Pan American, Department of Biology; 2-Texas Parks and Wildlife Department, HOH Fisheries Science Center).

We investigated the habitat use of the San Felipe gambusia (*Gambusia clarkhubbsi*) and the sympatric Tex-Mex gambusia (*G. speciosa*) using seines and minnow traps in their natural habitats in San Felipe Creek, Val Verde County, Texas. Seines were used in

two contrasting mesohabitat types and minnow traps were used in various habitats in a smaller area to test the habitat utilization of Gambusia in areas of moderate versus low flow environments as well as habitats with or without dense vegetation. We also conducted a series of experiments using artificial streams that mirrored these environment types. While there appeared to be a consistent trend of obtaining *G. clarkhubbsi* in sparsely vegetated habitats next to sources of swiftly flowing water and *G. speciosa* inhabiting sparsely vegetated, backwater areas in the winter and spring, *G. clarkhubbsi* was found in greater abundance than *G. speciosa* in dense vegetation regardless of flow regime. It also appeared that the young of the introduced armored catfish, armadillo del rio, *Hypostomus* sp., moved into the sparsely vegetated, flowing water areas in the summer, displacing *G. clarkhubbsi* from those habitats. The artificial stream experiments provided results similar to the minnow traps with respect to dense versus sparse vegetation utilization among the two species, but the artificial stream experiments were not consistent with the seining or minnow trap utilization patterns found with respect to flow, suggesting that other factors may also be involved in the habitat segregation of these species.

14:45 **Rediscovery of an "extinct" fish that was never described, *Gila* sp. of Parras de la Fuente, Coahuila, México: data on its description, ecology and captive care**

Garza-Tobón, Daniel*[1]; Gómez-Garza, Miguel Ángel[2]; Chavaría-Gallegos, Roberto[2]; Valdéz-González, Arcadio[3]. (1-Museo del Desierto, Saltillo, Coahuila, México; 2-La Casa de los Loros, Monterrey, N. L., México; 3-Laboratorio de Acuacultura de la UANL, Monterrey, N. L., México).

As part of the project "Status update on the Ictiofauna of Coahuila State; Captive Care and Reproduction of the Most Vulnerable and Near to Extinction Species" we visited the Parras basin at the beginning of 2006, conducting an extensive search for the fishes of this basin that have been considered extinct by several ichthyologists such as Contreras Balderas (1975 and 1985), Miller (1986), Miller, Minckley and Norris (2004) and others. Specimens of the cyprinid genus *Gila* were collected from this basin for the first time in 1964 and the last time in 1968 (Contreras Balderas 1996). After searching in several bodies of water, we found a subterranean river with considerable discharge that we decided to explore with the aid of speleology and scuba equipment. To our surprise, almost one kilometer inside the cave we found a group of fishes that have adapted to life in the dark, even though they retain normal appearance and coloration. We quickly realized that it was likely the undescribed *Gila* of Parras considered extinct for more than 30 years. The species is quite scarce; we counted about one dozen individuals that preferred to stay in slower and shallower waters. We collected 5 specimens to start the process of describing the species, learning about its biology, and attempting to keep and breed it in captivity. The specimens were compared to *Gila modesta*, which is the geographically closest described species, and different photographs were sent to experts. The Parras *Gila* are much bigger than *G. modesta* and have some 6 discernably different externally visible parameters. We are currently working on construction of a similar habitat in captivity in order to preserve the species and induce breeding by controlling temperature, water flow and darkness. This species in particular was difficult to bring into captivity. They have very delicate skin and quickly developed infections of external parasites as Ich, fin fungus and skin bacteria, therefore prophylactic treatments are planned for future collections.

15:00 **Changes in west Texas stream fishes 1954-2004**

Hubbs, Clark*[1]. (1-Section of Integrative Biology, University of Texas at Austin).

Springs have long been known to have a suite of environmental conditions that are sometimes drastically and sometimes subtly different than downstream habitats. Some of these factors include thermal stability in the springs and runs, differences in pH, conductivities, and fish assemblages. Many of these factors are different even when comparing spring versus downstream habitats as close as 100 m apart. These differences are often most pronounced in relatively large springs, and in these, different congeneric species often dominate in either the springs or in downstream areas. The spring-adapted species are also often unique to individual springs, having adapted to these specialized environments and are unable to compete with their downstream congener. Even when unique forms are not present, the species composition of the assemblage inhabiting the spring remains different than that found downstream and this appears to be a general phenomenon, found in many localities for not only fishes, but other aquatic organisms.

I have worked on the specific differences between spring fishes and stream fishes and their physical and chemical environments for the past 10 years. A preliminary study of eight spring and downstream riverine habitats showed this general pattern in springs in Texas. The present study expands this analysis to 15 spring systems (13 in Texas and 2 in Oklahoma) and further documents the differences between the fish assemblages and the environmental conditions found in these contrasting environments. Adaptations of spring organisms are thus correlated with environmental stability of those systems, and perturbations to spring habitats may not only undermine biodiversity, but could have legal ramifications relative the Endangered Species Act.

15:15 **Phylogenetic patterns within Australian desert gobies**

Unmack, Peter J.*[1]; Adams, Mark[2]. (1-Brigham Young University, Integrative Biology; 2-South Australian Museum, Evolutionary Biology Unit).

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 phylogenetic study was recently completed on one of the more interesting groups, the desert gobies (Gobiidae: *Chlamydogobius*) which have many parallels to the *Cyprinodon* pupfishes of North America. In both groups there are marine and freshwater species, they commonly occur as endemics in different spring complexes, they often inhabit harsh environments and as a result have extreme physico-chemical tolerances. The genus *Chlamydogobius* is thought to be endemic to Australia with one marine species *C. ranunculus* (Tadpole Goby) found across northern coastal Australia (sometimes in freshwater as well) and a radiation of five species within Central Australian Province (Lake Eyre Basin). Each species occurs within a distinct geographic area in tributaries of the largely dry Lake Eyre. *Chlamydogobius squamigenus* (Edgbaston Goby) mostly occurs in one small group of springs in the upper Cooper Creek catchment, *C. micropterus* (Elizabeth Springs Goby) occurs in one small group of springs in the middle Diamantina River catchment, *C. japalpa* (Finke Goby) occurs in the upper portion of the Finke River and is the only species found exclusively within riverine habitat, *C. gloveri* (Dalhousie Goby) occurs in Dalhousie Springs near the lowermost

Finke River, and the last species, *C. eremius* (Desert Goby) is found in numerous small springs and creeks mostly to the west of Lake Eyre. We used the complete sequence of the mitochondrial cytochrome *b* gene and allozyme electrophoresis on 53 presumptive loci to examine species relationships. Results from each dataset broadly agree on species boundaries, with the exception of *C. japalpa*, as it was not resolved as distinct from *C. eremius* in the allozyme analysis. However, it was distinct in the cytochrome *b* dataset and can be easily morphologically distinguished. Within cytochrome *b*, most nodes had high bootstrap values (> 80), with *C. ranunculus* recovered as the basal member of the genus. The more geographically isolated and morphologically distinct species *C. micropterus* was basal within Central Australia, followed by *C. gloveri*. The remaining three species (*C. squamigenus, C. japalpa, C. eremius*) were all closely related which is consistent with the more recent isolation of their drainages as well as overall morphological similarity. The phylogenetic patterns observed are likely the result of an initial invasion of *Chlamydogobius* into Central Australia from northern drainages during Late Miocene or Pliocene during a wetter climatic phase. Once within the Lake Eyre Basin they were able to disperse widely, and due to their ability to live in small, isolated, harsh environments they were able to colonize a number of spring systems. As climate became increasingly arid, it progressively fragmented and isolated these populations, resulting in a phylogenetic pattern broadly consistent with the known climatic fragmentation of these drainages.

15:30 **Effects of surface flow intermittence on a Great Plain's fish community, Pecos River, New Mexico**

Davenport, Stephen R.*[1]; Hoagstrom, Christopher W.[2]; Brooks, James E.[1]. (1-US Fish and Wildlife Service; 2-Weber State University).

The Pecos River, New Mexico maintains Great Plains' fishes that are rare and declining throughout their range, including the federally protected Pecos bluntnose shiner. Abundance, defined as density (fish/100 m2), of eight species of freshwater fish from the Pecos River, New Mexico was analyzed for changes in years with surface flow intermittence, compared to years without in a section of the Pecos River, New Mexico. Changes in standard length was analyzed for one fish, Pecos bluntnose shiner. Surface flow intermittence was most severe in 2002 and 2003, and by 2005 surface flow intermittence did not occur. Monitoring data showed that Pecos River fishes varied in response to surface flow intermittence, and this response varied by river section. Among eight common species, four species: red shiner, plains minnow, Arkansas River shiner and plains killifish experienced significant increases in mean density in at least one year, and four species, speckled chub, Rio Grande shiner, Pecos bluntnose shiner and western mosquito fish experienced decreases in mean density compared to previous years. Two species, Rio Grande shiner and Pecos bluntnose shiner continued to experience significant declines in abundance after cessation of prolonged intermittence.

15:45 **Wild fish health surveys required for fish repatriations**

Fulmer, James E.*[1]. (1-Arizona Game and Fish Department, Research Branch).

Arizona Game and Fish Department is restoring the native fish community to streams that were renovated and restocked with Apache trout, *Oncorhynchus apache*. Source

locations for native fish within each watershed that had renovated streams were identified, and then health assessments were performed on fish from these three locations to ensure they were free of any harmful pathogens; if harmful pathogens were present, then another source location had to be found. The three source locations were located on the main stem Black River, Little Colorado River, and the West Fork of the Black River. Parasite and tissue samples were analyzed and collected according to National Wild Fish Health Survey - Laboratory Procedures Manual 2nd Edition. Tissue samples were sent to two different fish health laboratories for pathogen testing during the course of the study. We attempted to collect sixty individuals of each catostomid and cyprinid species, and sixty salmonids at each location. Desert suckers, *Catostomus clarki*, and speckled dace, *Rhinichthys osculus*, were the targeted native species to be collected from Black River watershed. Bluehead suckers, *Catostomus discobolus*, and speckled dace were the targeted species on the Little Colorado River. Laboratory results indicated that a *Reovirus* was present in speckled dace from the Black River. A sample was submitted to University of California Davis for confirmation and initial confirmation method, electron microscopy, was inconclusive. Bacterial kidney disease, *Renibacterim salmoninarum*, was originally positive in three salmonids based on Enzyme Linked Immunosorbent Assay, but then later determined to be negative based on Quantitative Polymerase Chain Reaction tests. For the Little Colorado River, enteric redmouth, *Yersinia ruckeri*, was cultured and confirmed in one sample of the sixty speckled dace, and one brown trout sample was positive for bacterial kidney disease based on Quantitative Polymerase Chain Reaction tests. For the West Fork of the Black River, all bacteriology and virology tests were negative. However, the Pepsin-Trypsin Digest screen for whirling disease, *Myxobolus cerebralis*, on the third sampling event showed one *Myxobolus* species spore in a brown trout pooled sample, which was later confirmed to be *Myxobolus insidiosus*. Based on these results, we have decided not to use fish from the Black River, but instead will acquire desert suckers and speckled dace from the West Fork of the Black River for repatriations within the Black River watershed. We are looking for other source locations in the Little Colorado River watershed.

16:00 **Researcher-community collaborations in Cuatrociénegas: An update on the DFC-sponsored research station**

Hendrickson, Dean A.*[1]. (1-University of Texas at Austin).

Scientists, especially those associated with the Desert Fishes Council (DFC), have long recognized the importance of Cuatrociénegas (http://desertfishes.org/cuatroc), a Chihuahuan Desert oasis in Coahuila, México, as a hotspot of evolution, biodiversity and endemicity. Despite federal protection for over a decade, however, the area's integrity remains threatened by complex biotic and socioeconomic factors. A 2004 meeting of researchers working in the area sparked collaborations with interested local residents to benefit both conservation and the local community. Subsequently, a cooperative effort between the DFC (a U.S.-based NGO), DeSuValle (a local NGO), and the local Protected Area office, established a scientific research station to further facilitate research and interactions among researchers and between researchers and the local community. The station also helps connect resource managers (via researchers, its website and email lists) to a larger community of individuals willing to contribute wide-ranging skills to address management challenges. Exemplifying conservationists' high interest level in the area and benefits of cross-border collaborations, the 37th annual meeting of DFC

in November 2005 was the group's largest ever (250 mostly foreign participants), generating substantial direct local economic benefits and culminating in continued support of the research station, as well as acceptance by the group of a local invitation to meet there again in 2008. Since the 2005 meeting the station was opened to the research community in June 2006 at its new location. It has been christened the Centro de Investigación Científica de Cuatro Ciénegas, and it's web pages (http://desertfishes.org/cuatroc/CICCC.html) were added to the Desert Fishes Council Cuatro Ciénegas pages. By the time this paper is presented, the Advisory Board will have met twice (June and October) and the oral presentation of this paper will bring DFC members up-to-date with news from the station. A most noteworthy late addition to this abstract is the news received in September that the CICCC will be staffed by two U.S. Peace Corps volunteers starting in January 2007 - the very first Peace Corps volunteers in México's brand new Natural Resources program with SEMARNAT. They will be employees of the Reserve office, but fully dedicated to strengthening the ability of the CICCC to attain its mission, defined by its Advisory Board as "provides scientists, educators, students, naturalists and volunteers from around the world and especially the local community the opportunity to participate in research, workshops, and classes in one of the most biologically rich and unique desert aquatic ecosystems in the world. The Station seeks to promote knowledge and understanding of the special local fauna and flora, the environments in which they flourish, and the impacts humans have on them. By sharing data with the local community and management authorities, as well as among researchers, and facilitating exchanges between researchers and the local community we strive to provide the scientific basis necessary to assure eternal preservation of the unique biota of Cuatro Ciénegas for future generations."

Colaboraciones entre investigadores y la comunidad local en Cuatrociénegas: actualización sobre la estación de investigación científica de Cuatro Ciénegas patrocinado por el Consejo de Peces del Desierto

Los científicos, sobre todo los asociados con el Consejo de Peces del Desierto (CPD), han reconocido por muchos años la importancia de Cuatrociénegas (http://desertfishes.org/cuatroc), un oasis en el desierto Chihuahuense en Coahuila, México, como un centro de evolución, biodiversidad y endemismo. Sin embargo, y a pesar de protección federal desde hace más de una década, la integridad biótica del área sigue amenazada por diversos y complejos factores bióticos y socioeconómicos. En 2004 un congreso de investigadores trabajando en el área catalizó colaboraciones entre científicos y residentes del área, resultando en proyectos conjuntos para el beneficio de ambos la conservación y la comunidad local. Un esfuerzo cooperativo entre el CPD, una organización no gubernamental sin fines lucrativos (ONG) de los E.U., Desuvalle, una ONG de Cuatrociénegas, y la oficina del Área Protegida, luego estableció una estación de investigación en el pueblo con fines de facilitar la investigación y ampliar las interacciones entre investigadores y la comunidad. La estación además ayuda conectar los administradores del Área Protegida a una comunidad global (por medio de los investigadores mismos, un sitio web, y listas de emails) de individuos dispuestos a contribuir un amplio rango de habilidades y especializaciones para dirigirse a los desafíos que enfrenten el manejo exitoso del Área Protegida. Ejemplificando el alto nivel de interés entre los investigadores conservacionistas y los beneficios de colaboraciones trans-fronterizas, el treintiséptimo congreso anual del Desert Fishes Council en

Cuatrociénegas fue él mas grande (250 participantes, la mayoría del extranjero) del grupo en toda su historia, generó beneficios económicos sustanciales para la comunidad, y culminó en un acuerdo de apoyo fiscal de la estación de investigación y aceptación de una invitación del pueblo para reunirse nuevamente en Cuatrocienegas en 2008. Después del congreso en 2005 la estación abrió sus puertas a la comunidad de investigadores en junio de 2006 en su nueva instalación. Antes de la presentación de este trabajo en el congreso de 2006, la Junta de Asesores de la estación celebrara su segunda junta (junio y octubre) y la ponencia oral actualizará la audiencia hasta la fecha.

16:15 **DFC contributions of species information to FishBase, a pre-existing web based database, and the preservation of the tracking table purpose**

Hilwig, Kara D.*[1]. (1-Grand Canyon Monitoring and Research Center).

The Species Status Tracking Tables are the product of work initiated in 1970's by the Desert Fishes Council Area Coordinators to summarize annual changes in species status for all North American desert aquatic species at risk, and identify data gaps and research needs. Since the inception of this endeavor, many people have participated in discussions of its goals and objectives, as well as the data structure and content. It is the hope of the DFC's Area Coordinators that the data compiled in these tables, which we intend to be a long-term project of the DFC, will be published annually and/or made available via an online searchable database. In keeping with the mission of DFC to facilitate information exchange, the underlying goal of this project is to translate the collective knowledge of DFC members working in the field on the species of interest to the DFC into an easily accessible format. FishBase is a web-based relational database that contains specific species information to cater to different professionals such as research scientists, fisheries managers, and zoologists. FishBase was developed at the World Fish Center in collaboration with the Food and Agriculture Organization of the United Nations and many other partners, and with support from the European Commission. Since the early 1990's, a consortium of several fisheries research institutions from Australia, Africa, Europe, Indonesia, the Orient, Canada and the United States has supported FishBase. However, upon reviewing the information presented in the species accounts for North American fish species, there is a real need for the expertise of the DFC members. Kara Hilwig, Areas Coordinator, contacted FishBase representatives to discuss DFC collaboration, database structure and needs. An advantage of collaborating with FishBase is the contribution of data to a pre-existing, maintained and funded database; however, the disadvantage is a lack of the preservation of the chronology of conservation efforts for particular fish species. This presentation describes data needs and provides information about FishBase as it may relate to purposes of the Tracking Tables for further discussion of DFC involvement at the business meeting.

16:30 - 17:00 POSTER SESSION
Location: Visitor Center Auditorium.

16:30 **Government surplus bomb storage containers make ideal holding tanks for fish research**
Ward, David L.*[1]. (1-Arizona Game and Fish Department, Research Branch).

Government surplus bomb storage containers make good low-cost alternatives to commercially built fiberglass tanks for aquaculture. These containers were originally built for the U.S. government for use in transport and storage of JDAM missiles. The large number of missiles that have been used in recent years has created a surplus of these containers that are being sold to the public at low cost (<$10). They are resin transfer molded, 3/16th inch fiberglass and measure 5.5 feet long by 3.5 feet wide by 21 inches deep. We customized several of these containers with built-in filters to create 150-gallon, completely self contained recirculating systems for fish. Each tank was painted with aquaculture grade epoxy to produce a smooth gel coat interior. A small submersible pump pushes water up through a filter bed containing biofilter media and two layers of reticulated filter foam, providing both biological and mechanical filtration. The water then cascades back into the main tank providing aeration. The entire system is self contained with no external parts and is ideally suited for holding fish for research purposes.

16:30 **Control of nonnative crayfish in a small desert stream using sterilization**
Carveth, Corissa*[1]; Iles, Alison. (1-Arizona Game and Fish Department; 2-University of Arizona).

Introduced crayfish, in particular the Northern crayfish *Orconectes virilis*, have dramatic effects at multiple trophic levels on the ecosystems they invade. Due to the negative effects of crayfish on native flora and fauna there is a strong need to develop eradication methods for this species. Mechanical removal of crayfish has been a popular method for control of crayfish due to the ease at which crayfish can be caught. However, most mechanical removal methods are biased towards an age class and therefore can shift the population structure. Trapping crayfish alone can lead to a high proportion of large adults being removed and therefore removing a natural source of population regulation. After intensively trapping biologists have noted an increase in the overall number of crayfish present in a system. We propose using mechanical removal of crayfish combined with the sterilization of adult males to naturally regulate the populations. We chose to run the experiments in Campaign Creek, a small desert stream with a high abundance of crayfish. Large males were sterilized by removing sperm transfer tubes and put back into the system. We removed all juvenile males (> 27mm) and all females from the system. This poster will highlight the results of 6 months of sampling. Removal trips are currently scheduled twice a month and population estimates using the Lincoln-Peterson mark recapture method will be conducted every four months.

16:30 **Natural anti-parasitic properties of the Little Colorado River in Grand Canyon**
Ward, David L.*[1]; Hunt, Teresa A.[1]. (1-Ariona Game and Fish, Research Branch).

Water in the Little Colorado River within Grand Canyon is naturally high in salinity which may prohibit development of external fish parasites such as ich, *Ichthyophthirius multifiliis*. The Little Colorado River is one of the few locations where humpback chub, *Gila cypha*, spawn and reproduce every year. The naturally high salinity of the Little Colorado River, at base flow, may be one factor allowing survival of larval and juvenile humpback chub in this area of Grand Canyon. We compared salinity readings from the Little Colorado River to those reported in the literature as being effective at removing protozoan parasites from fish. In laboratory tests, juvenile roundtail chub, *Gila robusta*, infected with ich, recovered when placed into water from the Little Colorado River, but died if placed into fresh water. The naturally high salinity of the Little Colorado River at base flow (0.22 - 0.36 %), appears high enough to interrupt the life cycle of ich. Increased groundwater pumping in the Black Mesa hydrologic basin could alter the salinity of the Little Colorado River and be detrimental to endangered fish populations in Grand Canyon.

16:30 **Reintroduction of native fishes in Great Basin National Park**
Baker, Gretchen M*[1]; Wheeler, Kevin[2]. (1-Great Basin National Park; 2-Utah Division of Wildlife Resources).

Speckled dace, *Rhinichthys osculus*, mottled sculpin, *Cottus bairdii*, redside shiner, *Richardsonius balteatus*, and Bonneville cutthroat trout, *Onchorynchus clarkii utah* once composed native fish communities in streams of Great Basin National Park. Because of non-native fish predation and competition and habitat alterations, these species were extirpated. Great Basin National Park, in coordination with Nevada Department of Wildlife and Utah Division of Wildlife Resources, is restoring these native fish to the park. From 2000-2005, Bonneville cutthroat trout were reintroduced into several drainages and now inhabit five of the six historically occupied watersheds. In 2005 and 2006, fish from Lake Creek in Southern Snake Valley were introduced to Strawberry Creek and South Fork Big Wash. Reintroduction of these species into the Park may save these species from widespread extirpation and increase their chances of survival, especially in the face of new threats, namely the proposed largescale groundwater pumping in Snake Valley. However, there is no certainty that the removal of water from this region will not also negatively affect the streams where fish were reintroduced.

16:30 **Taxonomic analysis of early juvenile *Gila* from Yampa Canyon, Dinosaur National Monument**
Snyder, Darrel E.*[1]; Bestgen, Kevin R.[1]; Davis, Diane L.[1]; Finney, Samuel T.[2]. (1-Larval Fish Laboratory, Colorado State University, Fort Collins; 2-U.S. Fish and Wildlife Service, Vernal, Utah).

Most young-of-the-year *Gila* collected from Yampa Canyon in Fall 2004 by the U.S. Fish and Wildlife Service have the terminal and oblique mouth more typical of older roundtail chub, *G. robusta*, but the longer fins and other morphometric characters more typical of early juvenile humpback chub, *G. cypha*. Using a key for juvenile *Gila*, all

specimens preliminarily suspected to be humpback chub (about 10%, most having 10 anal-fin rays), as well as most of a subset of the remainder (having 9 anal-fin rays and suspected to be roundtail chub), were identified as humpback chub. To help assess whether all these fish are indeed humpback chub, we did more detailed morphological analyses with the same results for most specimens. These results are disturbing when considering the relative paucity of adult humpback chub in the region and we accordingly recommend that all designations of the analyzed juveniles be considered tentative. Perhaps the available diagnostic characters are inadequate or the criteria are based on too few known-identity specimens or populations. If these analyses are valid and representative of most of the juvenile *Gila* collected in Yampa Canyon, either the juveniles represent a genetically compromised (introgressed) population or the population of roundtail chub in this region has evolutionarily digressed from its typical form elsewhere.

16:30 **Baseline genetic survey of the Pecos bluntnose shiner**

Osborne, Megan J.*[1]; Turner, Thomas F.[1]. (1-University of New Mexico).

The Pecos bluntnose shiner is a threatened freshwater fish that is now restricted to less than 300 kms of the Pecos River in eastern New Mexico. Historically, Pecos bluntnose shiner was more widely distributed in the Pecos River, but construction of dams and reservoirs and altered flow regimes have caused local extirpations and alarming declines in the remaining population. The Pecos bluntnose shiner recovery plan (U.S. Fish and Wildlife Service 1992) includes reintroductions of the species into suitable habitat within its historic range and the development of a broodstock and/or refugial populations. Furthermore it states that the broodstock / refugial population size and spawning methods should seek to minimize the loss of genetic material. Prior to this study no genetic data had was available for Pecos bluntnose shiner. Between 2004 and 2006 genetic data was obtained from 332 individuals collected throughout the current range of Pecos bluntnose shiner. Individuals were screened for variation at seven microsatellite loci and the maternally inherited mitochondrial DNA. Major findings included I) contemporary Ne was a fraction of the historical estimate of effective size; ii) both mitochondrial and microsatellite DNA showed moderate to high levels of allelic diversity and mitochondrial DNA was characterized by an unusually high number of rare alleles that were present at frequencies of less than 2%, hence the majority of individuals had one of the two most prevalent haplotypes and iii) the Pecos bluntnose shiner population is panmictic (i.e., not genetically divergent between spatially distinct sampling localities) throughout its current range.

16:30 **Movement of bluehead suckers (*Catostomus discobolus*) in Grand Canyon**

Clark, Brian C.*[1]. (1-Arizona Game and Fish Department).

Little is known about the life history of bluehead suckers within the Colorado River in the Grand Canyon. Most studies on bluehead sucker movement have found that this species shows strong site fidelity with little long-distance movement. The mark-recapture data from bluehead suckers PIT tagged within the Grand Canyon was compiled and analyzed (1993-2006). We analyzed movement of individuals that were at large (time between capture events) for > 60 days. Mark-recapture data show that most bluehead

suckers in Grand Canyon exhibit strong site fidelity. However, several individuals have traveled greater than 10 miles and one bluehead sucker traveled over 150 miles upstream to the Little Colorado River. This information suggests that bluehead sucker aggregates in the Grand Canyon are not genetically isolated and that individuals are capable of traveling vast distances.

16:30 **An assessment of predatory threats to razorback sucker (*Xyrauchen texanus*)**
Karam, Abraham P.*[1]; Kesner, Brian R.[1]; Schooley, Jason D.[1]; Schwemm, Michael R.[1]. (1-Arizona State University, School of Life Sciences).

The razorback sucker (*Xyrauchen texanus*) has been the target of extensive recovery efforts throughout the Colorado River basin. Decades of research by state and federal agencies have provided isolated glimpses into the plight of the species and the various indices preventing recovery. Although many aspects have been investigated, the primary threat implicated for the decline of *X. texanus* includes ecological interactions with predatory nonnative fishes. We review the impacts of predatory threats to multiple life stages of razorback sucker and broaden existing knowledge on the problems and solutions for species recovery.

16:30 **Recent trends in estimated fish abundance and mass in Marble and Grand Canyons: a story of sucker success**
Rogers, R. Scott*[1]. (1-Arizona Game and Fish Department).

Standardized stratified random electroshocking has been completed yearly since 2000 in the Colorado River from Lee's Ferry to Diamond Creek. We calculate annual abundance estimates for rainbow trout, *Oncorhynchus mykiss*, brown trout, *Salmo trutta*, common carp, *Cyprinus carpio*, bluehead sucker, *Catostomus discobolus*, and flannelmouth sucker, *Catostomus latipinnis* by scaling catch per unit effort by estimated capture probabilities within the study area. These abundance estimates were then used to estimate mass for each species. Common carp abundance has varied between years but shows no apparent trend. Although carp is not the most abundance species, it accounts for the overall highest total mass of the species included in this analysis. Rainbow and brown trout abundance has declined significantly over the past five years, while sucker abundance has increased significantly over the past two years. Suckers accounted for only 5% of the total fish abundance in 2000 and over 70% in 2006, and flannelmouth sucker is now the most abundant species captured by electoshocking. It is likely that warmer water temperatures and reduced trout abundance over recent years have contributed to increased recruitment of suckers.

16:30 **Reproductive issues in the Jewel Cichlid, *Hemichromis guttatus*, an exotic species in Poza Churince, Cuatro Ciénegas, Coahuila, México**
Espinoza-Hernández, Salvador[1]; García-Ramírez, Maria Elena*[1]; Lozano-Vilano, Maria de Lourdes[1]. (1-Universidad Autónoma de Nuevo León, FCB).

The Jewel Cichlid, *Hemichromis guttatus*, is an exotic fish established in Poza Churince, where it causes troubles for the native and endemic species by competing with them for space and food. The species is reported to have a considerable impact in the

areas where it is found. The principal objective of this study was to describe some important aspects of the growth and reproduction of *H. guttatus*. We reviewed specimens collected from Poza Churince in January to December of 2002 and archived at the Colección Ictiológica of the Facultad de Ciencias Biológicas, UANL. We dissected 550 specimens (females and males), of which 25 females were analyzed from each month. Total length, standard length and total weight were measured for each specimen. Gonads were extracted to count ova, and the stage of gonadic development was noted, using a scale proposed by Solorzano (1961). The sex proportion was 1.09 : 0.91 (Males : Females). We observed six gonadic development stages (I, II, III, IV, V, VI), and mature females occurred in all four seasons. Size at first maturity for females was 31.3-41.2 mm in most months, and the smallest mature female encountered was 26.7 mm SL (0.50 gr). Total fecundity ranged from 73-498 ova (average 215 ova). Reproductive activity occurred throughout the year, with a decrease of activity in the spring and increase in October.

El Cichlido joya, *Hemichromis guttatus* , es un pez exótico que se encuentra establecido en la poza Churince, donde ha provocado problemas a las especies nativas y endémicas por competir con ellas por espacio y alimento. Actualmente esta especie es reportada como un fuerte impacto en las áreas donde se encuentra. El objetivo principal de este estudio fue describir algunos aspectos de crecimiento y reproducción de H. guttatus. Se revisaron los ejemplares recolectados de Enero a Diciembre del 2002, estos se tomaron de la Colección Ictiológica, (CI) Facultad de Ciencias Biológicas, UANL. Se disectaron 550 ejemplares hembras y machos de los cuales se analizaron 25 hembras por mes: Se consideraron los siguientes datos: Longitud Total; L. Patrón; (en mm); peso total (gr). Los ejemplares se disectaron y se extrajeron las gónadas, se contaron los ovocitos. Se determino la proporción sexual, los estadios de desarrollo gonádico, con la escala propuesta por Solórzano (1961). La talla de la primera madurez, para las hembras fue de 41.2-31.3 mm como talla promedio, en la mayoría de los meses. La proporción de sexos encontrada fue 1.09 M: 0.91 H, se detectaron hembras maduras en las cuatro estaciones del año. La talla de la primera madurez gonádica se encontró a 26.7 mm de LP con un peso de 0.50 gr. Aparecieron 6 estadios de madurez gonádica (I, II, III, IV, V, VI). Se econtró actividad reproductiva en todo el año pero esta es mayor durante el mes de Octubre. La fecundidad total menor fue de 73; y la mayor de 498 y la media de 215 ovocitos respectivamente, se sugiere que H. guttatus se reproduce durante las cuatro estaciones del año disminuyendo en primavera.

16:30 **The Native Fish Program at the Arizona Game and Fish Department**

Spencer, Amanda*[1]; Meka, Julie[1]; Cantrell, Chris[1]; Timmons, Ross[1]. (1-Arizona Game and Fish Department).

The Arizona Game and Fish Department’s Native Fish Program works to bring federally listed native fish species back to thrive in their native habitats and ensure their persist in the future. The program relies heavily on multi-agency cooperation efforts, outreach and education, habitat improvement projects, fish and habitat surveys and monitoring, establishment of captive populations used for stocking purposes, and translocations. Some of the achievements over the last year include the establishment of a roundtail chub brood stock, the stocking of desert pupfish into the Agua Fria drainage,

several Apache trout projects, and new opportunities resulting from the downlisting of Gila trout.

16:30 **Factors affecting development rates and population densities of fairy shrimp, *Branchinecta packardi*, in desert rock pools: is this the fastest species in the world?**
Behunin Thompson, Tammy*[1]; Rader, Russell B.[1]. (1-Brigham Young University).
[Hubbs Award student contestant]

Phyllopods (fairy shrimp, tadpole shrimp, and clam shrimp) are the species that best characterize freshwater rock pool communities around the world because of their unique adaptations to temporary conditions. The fairy shrimp, *Branchinecta packardi*, is one of the most abundant animals in temporary rock pools of the Colorado Plateau. Some rock pools can fill and dry in less than 2 days during the hottest part of the year (July). We conducted a lab experiment to examine the relationship between pool evaporation rates and rates of fairy shrimp development. We introduced 20 early instars (3 days old) to each of 20 containers consisting of 4 treatments: 5 containers dried in 6 days, 5 in 8 days, 5 in 10 days, and 5 remained continuously inundated for the duration of this experiment (16 days). At the end of each period we measured the total number of shrimp, the body size of multiple individuals, and the number of eggs for multiple females in all treatments. We also counted the total number of eggs produced in each treatment. We found that fairy shrimp can complete their life cycle in six days. This is one of the fastest rates of development in the animal kingdom. However, percent survival, total body length, and fecundity showed a positive linear relationship with length of pool inundation. That is, 13, 38, 48, and 39 percent of the fairy shrimp survived after 6, 8, 10, and 16 days of inundation. Also, fairy shrimp produced on average 27.2, 365.8, 790.4, and 1214.8 eggs and were 6.8, 10.7, 11.7, and 13.1 millimeters long after 6, 8, 10, and 16 days of inundation. All else being equal, pools that persist longer than 16 days can support more fairy shrimp than more temporary pools. We hypothesize that fairy shrimp will reach their maximum population sizes at intermediate lengths of inundation (16 to 30 days). Permanent pools contain predators that can reduce fairy shrimp numbers, whereas our data shows that survivorship, size, and fecundity are reduced in very temporary pools. We suggest that climate changes that reduce the number of pools with intermediate lengths of inundation will vastly reduce fairy shrimp populations in desert ecosystems.

16:30 **Species composition of a desert rock pool metacommunity**
Kmetzsch, Cameron S.*[1]; Rader, Russell B.[1]. (1-Brigham Young University).
[Hubbs Award student contestant]

Rock pools are one of the most unique and threatened aquatic habitats in the world. Changes in global climate could alter precipitation patterns and disrupt the annual cycle of filling and drying to which this community has evolved. Previous misconceptions assume that all rock pools are temporary habitats. We identified invertebrates and vertebrates (tadpoles) from 117 pools in three adjacent drainages near Moab Utah. Over a period of two years we have shown that at least 20 pools in each drainage have maintained constant wetted conditions with moderate seasonal fluctuations in water levels, despite air temperatures near 50 C (120 F) on the open hardpan. These "permanent" pools are shaded within deeply incised canyons called, Tinajas. Tinajas are cut into the sandstone bedrock by torrential flows during summertime cloudbursts. We

quantified rates of pool evaporation and invertebrate dispersal between pools at the hottest time of the year (July). We also determined differences in community composition along a pool permanency gradient. Pool evaporation rates vary depending on shading and wind exposure, and there were numerous individuals and adults of aquatic taxa dispersing between pools even during July. Interestingly, dispersal was 3.5x greater in the upstream direction even though most permanent pools occurred downstream. Dispersal between drainages did occur but was vastly reduced. Although many of the most temporary pools were already dry, we found that predators (2 backswimmer species, 1 dytiscid beetle, 1 hydrophilid beetle, 1 water strider, and 1 species of whirligig beetles) were most abundant in the more permanent pools, whereas fairy shrimp and a biting midge, were most abundant in the more temporary pools. Although tadpoles occurred in both permanent and temporary pools, those in temporay pools did not have time to complete development and suffered complete mortality. Future research will determine the importance of dispersal in determining local patterns of diversity in this fascinating metacommunity

17:00 - 18:00 **BUSINESS MEETING**
Location: Visitor Center Auditorium.

19:00 - 00:00 **BANQUET**
Location: Date Grove between Furnace Creek Ranch and the Visitor Center.

Saturday, 18 Nov. 2006

08:30 - 12:00 GENERAL SESSION - 5
Location: Visitor Center Auditorium.

08:30 **Geographic patterns of genetic variation in the catostomid fish Utah sucker**
Cardall, Brian L.*[1]; Mock, Karen E.[1]. (1-Utah State University, Dept. Wildland Resources). **[Hubbs Award student contestant]**

We report the discovery of a major subdivision (4.5% mtDNA sequence divergence) in Utah suckers (*Catostomus ardens*) between the ancient Snake River drainage and the Bonneville Basin. This boundary has not previously been recognized in Utah suckers based on morphologic variation, but has been recently described in two endemic cyprinids in the region. Populations in valleys East of the Wasatch Mountains in Utah clustered with the Snake River populations, suggesting that these valleys may have had an ancient hydrologic connection to the Snake River. We also found evidence of population isolation within the Bonneville basin, corresponding to two Pleistocene subbasins of ancient Lake Bonneville. Morphological and neutral genetic markers seem to vary along different axes in different portions of the range of this taxon, providing an interesting system for studying the contributions of neutral and adaptive variation to species diversity.

Patrones geográficos de la variación genética en el pez catostomido matalote de Utah

Divulgamos el descubrimiento de una subdivisión importante (divergencia de la secuencia del mtDNA 4.5%) en matalote de Utah (*Catostomus ardens*) entre el drenaje antiguo del río Snake y la cuenca de Bonneville. Este límite no se habia reconocido antes en matalote de Utah basado en la variación morfológica, pero fue descrito recientemente en dos ciprínidos endémicos en la región. Las poblaciones en valles al este de las montañas de Wasatch en Utah agruparon con las poblaciones del río Snake, sugiriendo que estos valles pudieron haber tenido una conexión hidrológica antigua al río Snake. También encontramos evidencia del aislamiento de la población dentro de la cuenca de Bonneville, correspondiendo a dos subcuencs del Pleistoceno del lago antiguo Bonneville. Los marcadores morfológicos y genéticos neutrales parecen variar a lo largo de diversas hachas en diversas porciones del rango de este taxon, proporcionando un sistema interesante para estudiar las contribuciones de la variación neutral y adaptante a la diversidad de la especie.

08:45 **Innovative techniques are contributing to knowledge of three native Colorado River Basin fishes in headwater streams of Wyoming**
Compton, Robert I.*[1]; Hubert, Wayne A.[1]; Rahel, Frank J.[2]. (1-University of Wyoming, Wyoming Cooperative Fish and Wildlife Research Unit; 2-University of Wyoming, Department of Zoology and Physiology). **[Hubbs Award student contestant]**

Bluehead sucker, *Catostomus discobolus*, flannelmouth sucker, *Catostomus latipinnis*, and roundtail chub, *Gila robusta*, dominate the upper portion of Muddy Creek, a tributary to the Little Snake River in south-central Wyoming. Our goal is to determine the effects of human-made instream structures on movements and population dynamics of the three species in the system. Fish were captured and implanted with passive integrated transponder (PIT) tags in three segments of Muddy Creek formed by human-made structures. Movements over structures are being evaluated using fixed locality monitoring stations that record tagged fish upon passage and by electrofishing throughout the stream system. Estimates of the abundance of each of the three species in each segment are being obtained using three-pass depletions. Pectoral fin rays are being used to acquire age and growth data without the need to sacrifice fish. To our knowledge these techniques have never been combined to study the three species in small streams. Data on movements, abundance, age structure, and growth will be synthesized to assess the effects of population fragmentation on each of the three species. Preliminary results suggest that all three species are quite mobile, move downstream over human-made structures, and bluehead suckers and flannelmouth suckers carry out a spawning run into an ephemeral tributary. Source and sink dynamics are probably occurring among segments of Muddy Creek formed by human-made structures.

09:00 **Evidence for high levels of gene flow among populations of a widely distributed anadromous lamprey *Entosphenus tridentatus* (Petromyzontidae)**

Goodman, Damon H. [1]; Reid, Stewart *[2]; Docker, Margaret[3]; Kinziger, Andrew[4]. (1-U.S. Fish and Wildlife Service, Arcata Field Office; 2-Western Fishes; 3-University of Manitoba, Department of Zoology; 4-Humboldt State University, Fisheries Biology Department).

The North American distribution of Pacific lamprey, *Entosphenus tridentatus* spans from Alaska south to Baja California, Mexico. Documentation of declining populations, combined with a recent petition to list the under the Endangered Species Act in January 2003, have increased interest in the conservation of the *E. tridentatus*. Currently there is no information available on genetic variability within and between populations of E. tridentatus. To assess levels of genetic variability, we used restriction fragment length polymorphism to detect nucleotide variation at 19 sites known to be variable in *E. tridentatus* mtDNA. Over 3,000 individuals of *E. tridentatus* have been collected from 54 drainages between British Columbia and Southern California. Analyses of 1246 samples reveal the presence of 29 haplotypes with three haplotypes occurring at high frequencies throughout all populations.

09:15 **Effect of Asian tapeworm on the growth and mortality of Yaqui chub and Yaqui topminnow**

Kline, S. Jason*[1]; Bonar, Scott A.[1]. (1-Arizona Cooperative Fish and Wildlife Research Unit). **[Hubbs Award student contestant]**

Asian tapeworm *Bothriocephalus acheilognathi*, a parasite known to be pathogenic to cyprinid fishes, is established in San Bernardino National Wildlife Refuge, southeastern Arizona, USA. The San Bernardino refuge is home to endangered Yaqui chub *Gila purpurea*, and Yaqui topminnow *Poeciliopsis occidentalis sonoreinsis*, our experiment

measured the effects of Asian tapeworm on the growth and mortality of these species. The experiment employed forty 75.8-L aquaria, with 10 different treatments, each having 4 replicates. We stocked fish at 2 single species densities and 1 mixed species density to see if competition has an impact on infection effects. We found a significant difference between growth rates of Yaqui chub that were exposed to Asian tapeworm and chub those that were not. We did not find a significant difference between growth rates of Yaqui topminnow that were exposed and those that were not. This may due to low infection rates caused by the small gastro-intestinal tract of topminnow. We did not find a difference for mortalities between exposed and unexposed tanks, regardless of the species. We also report the first successful laboratory propagation of Yaqui chub and Yaqui topminnow.

09:30 **Movement of leatherside chub within a Utah stream**

Rasmussen, Josh E.*[1]; Belk, Mark C.[1]. (1-Brigham Young University, Department of Integrative Biology). **[Hubbs Award student contestant]**

Although the southern clade of leatherside chub (*Gila copei*) is not officially recognized as a threatened or endangered species, it is a species of special concern. Like many native western species, the numbers of leatherside chub throughout its historical range have declined substantially and become fragmented. Dispersal within and among populations may be an important factor in the preservation of this species. We assessed the importance of several factors on the movement of chubs within Salina Creek (Sevier County, Utah, USA). We manipulated the system by creating "open habitat," removing all chubs from 0 to 50 or 50 to 100 m upstream of 25 m sections in which all chubs (n = 1, 061) were measured, behaviorally assayed for a tendency to move, and marked accordingly. Twelve 25 m sections were established in the fall of 2005 and re-sampled approximately one year later. Approximately 26% of all marked chubs were recaptured. Size and proximity of individuals to open habitat were important factors in predicting the movement of individuals. Distances moved by individuals were also influenced by the quality of habitat, as measured by the by the density of chub within a given area. However, behavioral assays appear inconclusive for predicting dispersal. Future management plans for habitat improvements and reestablishment of leatherside chub need to consider the dispersal tendencies of the species.

09:45 **The role of premating isolation in mediating the co-occurrence of *Gambusia affinis* and *G. nobilis***

Swenton-Olson, Daniella M.*[1]. (1-University of New Mexico, Department of Biology). **[Hubbs Award student contestant]**

In studies of speciation, premating and postmating isolating mechanisms can drive divergence between two species. In allopatric speciation, premating isolating mechanisms usually drive reproductive isolation upon secondary contact. Sexual Selection Isolation (SI) may be an important mechanism affecting this isolation. SI predicts that species will be isolated principally via assortative mating, the preference to mate with members of one's own species over members of another species.

I examined the importance of premating reproductive isolation via SI in *Gambusia affinis* and *G. nobilis*. The species diverged in allopatry but now both species

co-occur in the Southwestern U.S. The highly invasive *G. affinis* has been introduced to populations of the federally endangered *G. nobilis* at Bitter Lake National Wildlife Refuge near Roswell, NM. It is unclear if the species are hybridizing or else are segregating via behavioral or ecological means thereby maintaining unique species' identities. If the two species are isolated by behavioral differences driven by sexual selection, I predict that they will assortatively mate and not hybridize. In laboratory studies I examined species' mating preferences in both male and female mate choice trials. These lab studies will determine the potential of these two species to hybridize and the strength of premating isolating mechanisms. Complimentary ecological and genetic studies will establish if the two species differ in their habitat and food preferences and the extent to which they have introgressed in the field.

10:00 **Preliminary study of the physiochemical quality of water in the Santa Catarina River, Nuevo León, México**

Lozano-Vilano, Maria de Lourdes[1]; Leza-Hernandes, Jesus Maria*[1]; García-Ramírez, Maria Elena[1]; Romero-Melchor, Diana Liceth[1]; Contreras-Balderas, Armando[1]. (1-Universidad Autónoma de Nuevo León, F.C.B.). **[Miller Award student contestant]**

The Santa Catarina River originates in the Sierra la Huasteca and flows to the San Juan-Bravo River in the State of Nuevo León, passing through the counties of Santa Catarina, San Pedro Garza García, Monterrey, Pesquería, Guadalupe, Juárez and Cadereyta, as well as the urban zone of Monterrey. Research on water quality in this area is limited. The main objective of this study was to determine the physicochemical quality of the sampled areas and to quantify their behavior. There were made evaluations of habitat in the selected areas. Water samples were taken from fourteen sites on the river. We evaluated six water quality variables: total alkalinity, calcium, chloride, magnesium, nitrates, sulfates; these parameters were represented by mg/l color, mg/l PT and turbidity (FTU), using a photometer (YSI 9000); dissolved oxygen (mg/l) and temperature (ºC) were measured in situ (YSI 55). The results indicate wide ranges of anions, represented by sulfates. By dominance order the cations indicate that Ca and Mg observed high values of alkalinity, that shows the chemical specter of the represented habitat. In the graphical analysis we can see that alkalinity rates are 215.430 mg/l, this parameter is related with calcium which present rates of 163-305 mg/l, sulfates values are 95-200 mg/l, the three highest cases are out of ecological criteria of the water quality according to CNA (2002).

El Río Santa Catarina nace en Sierra de la Huasteca y desemboca en el Río San Juan-Río Bravo en el estado de Nuevo León, atraviesa los municipios Santa Catarina, San Pedro Garza García, Monterrey, Pesquería, Guadalupe, Juárez y Cadereyta; dentro de la zona conurbana de Monterrey. Los estudios realizados sobre calidad del agua para este río son aislados. El objetivo principal de esta investigación fue conocer la calidad fisicoquímica de las áreas muestreadas y cuantificar su comportamiento. Se hizo la toma de las evaluaciones del hábitat de las áreas seleccionadas. Se tomaron muestras de agua de 14 localidades a lo largo del río. Fueron evaluadas las siguientes variables de la calidad del agua: alcalinidad total, calcio, cloruros, magnesio, nitratos, sulfatos, estos parámetros fueron representados en mg/l color mg/l Pt y turbidez (FTU) para estos análisis se utilizo un fotómetro YSI 9000; in situ se tomo el oxigeno disuelto en mg/l y temperatura (°C) se tomaron con un aparato YSI 55. Los resultados mostraron amplios

rangos de aniones representados por sulfatos. Los cationes se mostraron en orden de dominancia fue Ca y Mg observados en altos valores de alcalinidad, indicando el espectro de la química del hábitat representado. En el análisis de las gráficas se observo que la alcalinidad se presenta entre 215-430 mg/l, este parámetro esta mas relacionado con el calcio que se presenta entre los 163-306 mg/l, los sulfatos con valores de 95-200 mg/l, los tres casos por ser altos, están fuera de los criterios ecológicos de calidad del agua CNA (2002).

10:15 **Preliminary list of the fishes of the Santa Catarina River, tributary to the San Juan-Bravo, Nuevo León, México**

Lozano-Vilano, Maria de Lourdes[1]; Romero-Melchor, Diana Liceth*[1]; Leza-Hernandes, Jesus Maria[1]; García-Ramírez, Maria Elena[1]; Contreras-Lozano, Jorge Armando[1]. (1-Universidad Autónoma de Nuevo León, F.C.B.). **[Miller Award student contestant]**

The Santa Catarina River, tributary of San Juan-Bravo River, is located in the State of Nuevo León and originates in the Sierra la Huasteca. It flows through the counties of Santa Catarina, San Pedro Garza García, Monterrey, Pesquería, Guadalupe, Juárez and Cadereyta, as well as the urban zone of Monterrey. The river is heavily impacted by anthropogenic activities like urban discharges. The main objective of this study is to determine the present icthyofauna of the river, which has had no taxonomic studies. Although, there are historical documents that mention fishing for eels, snooks, catfish, “piltontes”, “payones”, “besugos”, “dorados” and mojarras in the rivers of Nuevo León during the 1700-1800’s. For the present study we sampled fourteen sites throughout the Santa Catarina River, from the Puente Venustiano Carranza, where there is a spring (upstream there was no water), to the confluence with the San Juan River, and one site in the San Juan. We collected 2,160 specimens, representing 19 species in 16 genera and seven families. Four were introduced species: *Cyprinus carpio*, *Heterandria bimaculata*, *Poeciliopsis gracilis* y *Oreochromis aureus*, and one is a hybrid between *Xiphophorus couchianus* (native) and *X. maculatus* or *X. variatus* (both exotics). It is notable that species diversity increases near the San Juan River.

El Río Santa Catarina, tributario del Río San Juan-Río Bravo, se localiza en el Estado de Nuevo León, nace en la Sierra de la Huasteca, y atraviesa la zona conurbana de Monterrey, en los municipios de Santa Catarina, San Pedro Garza García, Monterrey, Pesquería, Guadalupe, Juárez y Cadereyta; debido a esto se encuentra fuertemente impactado por actividades antropogénicas entre ellas las descargas urbanas. El objetivo principal es determinar el estado actual del Río, además de conocer cual es su ictiofauna, ya que a la fecha no hay trabajos taxonómicos al respecto, existen monografías en las que mencionan que en los años 1700-1800 se pescaba en los Ríos de Nuevo León, anguilas, robalos, bagre, piltontes, payones, besugos, dorados y mojarra. Para este trabajo se realizaron 14 colectas a lo largo del río, iniciando en el Puente Venustiano Carranza que fue donde afloraba el agua (mas arriba se encontraba seco), hasta su unión con el San Juan y una más en este último. Se revisaron 2,160 ejemplares, repartidos en 7 familias, 16 géneros y 19 especies, de las cuales 4 son introducidas *Cyprinus carpio*, *Heterandria bimaculata*, *Poecliopsis gracilis*, y *Oreochromis aureus*, y una mas resultado de la hibridación con 2 especies exóticas *Xiphophorus couchianus* (nativa) con *X. maclatus* y *X. variatus* (exóticas); Es notorio que se encuentra mayor cantidad de especies hacia las juntas con el río San Juan.

10:30 **Genetic structure and management history of Mohave tui chub (*Siphateles bicolor mohavensis*)**

Chen, Yongjiu*[1]; Parmenter, Steve[2]; May, Bernie[3]. (1-North Dakota State University, Department of Biological Sciences; 2-California Department of Fish and Game; 3-The University of California, Davis, Department of Animal Science).

The Mohave tui chub (*Siphateles bicolor mohavensis*) is the only fish native to the Mojave River, California. Mass intergeneric hybridization with introduced arroyo chubs (*Gila orcutti*) displaced tui chubs from the Mojave River in the 1930s. Mohave tui chubs persisted in one relictual population, Mohave Chub Spring (MC Spring), from which three refuge populations were derived. Employing 12 microsatellite DNA loci, our study characterized genetic diversity of populations of Mohave tui chub, and examined the taxonomic status of the cyprinid fish common in the Mojave River today. We found only unhybridized arroyo chubs in the Mojave River, and unhybridized Mohave tui chubs in the refugial populations. Population substructure is evident among the four Mohave tui chub populations. Contrary to our expectation, the source population at MC Spring has significantly fewer alleles and lower heterozygosity than populations historically derived from it. Our findings suggest that genetic drift due to a small effective population size in MC Spring has reduced genetic diversity in the five decades since the original transplants were made. A bottleneck of 10 individuals during the founding of the Camp Cady population is reflected in significantly lower genetic diversity and divergence of that population from all others. Two additional refuges possess significantly higher levels of diversity, Lake Tuendae and China Lake. We recommend instituting artificial gene flow to rebuild genetic diversity in MC Spring and Camp Cady, and to better conserve allelic diversity in the species as a whole. New populations established in the future should be derived from Lake Tuendae and China Lake.

10:45 **Biotic evaluation of Mohave tui chub, *Siphateles bicolor mohavensis* habitats; Lake Tuendae and MC Pond, Mojave National Preserve, CA**

Henkanaththegedara, Sujan, M.*[1]; Stockwell, Craig A.[1]. (1-North Dakota State University, Department of Biological Sciences). **[Hubbs Award student contestant]**

Mohave tui chub, *Siphateles bicolor mohavensi* is restricted to four habitats in southern California; M.C. Pond, Lake Tuendae, Camp Cady and China Lake NWAS. The former two habitats occur in the Mojave National Preserve, and M.C. Pond is the presumptive founding stock for all existing populations. There has not been a comprehensive evaluation of invertebrate diversity for any of the habitats occupied by Mohave tui chub. This type of information is of interest because a recent change in lake clarity at Lake Tuendae was associated with the introduction of western mosquitofish, *Gambusia affinis*. In other shallow lake systems, lake clarity has been reduced in response to increased abundance of small fishes. We examined the composition of invertebrates in both Lake Tuendae and M.C. Pond using two different sampling methods, vertical tow net and Van Dorn type horizontal water sampler. Fifteen and fourteen invertebrate taxa were recorded respectively from Lake Tuendae and MC Pond. We observed biologically meaningful differences in aquatic invertebrate communities between the two sites. Amphipods and immature stages of Plecopterans and Odonates were recorded only from Lake Tuendae. By contrast, Oligochaetes and Rotifers were

recovered only from MC Pond where they were relatively abundant (20.7% and 8.39%, respectively). The Lake Tuendae community was dominated by Ostracods (39.48%) which were poorly represented in MC Pond (0.26%). Copepods were the most dominant group in MC Pond (43.31%) and are also well represented in Lake Tuendae (38.75%). Cladocerans were well represented in both habitats. We also observed differences in the invertebrate density as a function of sampling technique. Horizontal sampler yielded more invertebrates than tow net in both Lake Tuendae (tow net=5367/m ³, horizontal sampler=103346/m ³; t = 1.71, p < 0.001) and MC Pond (tow net=6228/m ³, horizontal sampler=297250/m ³; t= 2.353, p = 0.013) probably because of the innate characteristics of each sampling method. Additionally there is no significant difference in taxa diversity (H') of invertebrates between the two sampling methods in Lake Tuendae (t= 1.708, p = 0.464) and in MC Pond (t= 2.353, p = 0.453). The application of these techniques for monitoring Mohave tui chub habitats will be discussed.

11:00 **Techniques for laboratory spawning of Mohave tui chub**

Archdeacon, Thomas P.*[1]; Bonar, Scott A.[1]. (1-University of Arizona, Department of Wildlife and Fisheries Science). **[Hubbs Award student contestant]**

The Mohave tui chub, *Gila bicolor mohavensis*, is a federally endangered fish that has not previously been spawned in captivity. Laboratory spawning of fishes can be important for recovery efforts by reducing collection of wild fish for translocations and providing individuals for experimental studies. Mohave tui chub spawned under a photoperiod of 14 h light and 10 h dark, after we lowered the temperature to about 9°C for 30 days, then raised it to 21°C over an 8-week period, and provided artificial plants as spawning substrate. We used no hormones and produced over 1,700 larval fish from three spawning events.

11:15 **Collection and rearing of endangered Lost River and shortnose suckers in Upper Klamath Lake**

Russell, Kent N.*[1]; Buettner, Mark[1]; Larson, Ron[1]. (1-US Fish & Wildlife Service, Klamath Falls, Oregon).

The Lost River sucker, *Deltistes luxatus*, and shortnose sucker, *Chasmistes brevirostris*, both endemic to Upper Klamath Lake in south central Oregon, were listed as endangered in 1988. Although researchers in the past have raised juvenile suckers, no culturing techniques for these two species have been documented. During June 2006, US Fish and Wildlife Service personnel collected 3,700 larval fishes 10-25mm long (presumably sucker larvae) in Lake Euwauna and lower Williamson River at night using underwater fishing lights and light traps. Larvae were initially placed in 30 gallon aquariums with continuous flow-through water from a 40,000 gallon fertilized pond. The larvae were fed live baby brine shrimp and naturally occurring plankton. As the larvae grew to 25-30mm and metamorphosed into juvenile fish, Razorback sucker chow was gradually added to their diet. Larvae and juveniles appeared to grow well on this feeding regime, but the artificially-reared juveniles were generally smaller than wild-reared juveniles collected in the Link River during the third week in August. Juveniles were transferred to 750 gallon tanks, also with continuous flow-through water from the pond,

during late July and early August. As of the first week in August, overall survival was low (14%) due to (1) predation from young of the year yellow perch, Perca flavescens, inadvertently collected with the sucker larvae, (2) several outbreaks of ich, Ichthyophthirius multifiliis and (3) high, potentially lethal water temperatures (30°C) during July. The results of this study indicate that large numbers of wild Lost River and shortnose sucker larvae can be successfully collected and reared in a hatchery environment to provide juveniles for experiments and potential supplementation efforts in the future should either of these needs exist.

11:30 **Refuge for native fish: Aquatic and riparian habitat restoration**

Blasius, Heidi B*[1]. (1-Bureau of Land Management, Safford Field Office).

Aquatic and riparian habitats throughout the southwestern United States are disappearing, being altered, and invaded with nonnative aquatic species, making them unsuitable for native fish. This loss of habitat for native fish and the inability to control nonnative fish species in larger riverine habitats has resulted in the need and creation of refuge aquatic habitats free of nonnatives. Refuge habitats can be constructed or restored to provide additional and suitable habitats for native fish either permanently or until natural habitats are restored.

Two artesian well habitats, Howard Well and Posey Well, located in the San Simon, were restored to provide potential habitat for native fish and to restore terrestrial habitat for wildlife. Restoration efforts included dredging and cattail removal to create open water habitat, application of bentonite to seal the pond bottom, addition of rock structures to provide aquatic habitat diversity, mechanical and chemical vegetation removal, native aquatic and terrestrial seeding and planting, installation of bat roosts, and long-term commitment to maintenance.

11:45 **Long-term genetic studies in the Rio Grande silvery minnow to examine effects of population decline and of supportive breeding**

Osborne, Megan J.*[1]; Turner, Thomas F.[1]. (1-University of New Mexico).

The use of captive, refugial populations and supportive breeding are increasingly employed as tools to protect threatened and endangered species from extinction. Theoretical and experimental studies show that captive spawning, rearing and augmentation can have adverse genetic effects on the wild population and may compromise the ultimate goal of species recovery. The Rio Grande silvery minnow is an endangered cyprinid that is now found only in the Rio Grande in New Mexico. The distribution of this species has been greatly reduced as a consequence of competition with introduced species, habitat disturbance including river fragmentation and altered flow regimes. We collected genetic data between 1987 and 2006 from wild silvery minnow and from 22 different captive-reared and spawned populations to examine the effects of population decline and of supplementation. This data set represents one of the longest temporal data sets of a non-salmonid species and provides crucial insights into the genetic consequences of population decline and of supplementation progams. Major findings include i) the genetic effective size is orders of magnitude smaller than census size estimates and apparent increases in the population size in 2004 and 2005 have not been accompanied increases in genetic effective size, ii) supplementation of the

population with captively spawned and reared individuals has maintained genetic diversity and iii) different strategies of captive rearing and spawning have different outcomes for genetic diversity. This data provides critical information for managers charged with recovering the species that could not be provided by demographic data alone.

12:00 - 13:30 LUNCH

13:30 - 17:00 SPECIAL SESSION - Devil's Hole, Captive & Refuge Populations
Location: Visitor Center Auditorium.

13:30 **Devils Hole pupfish recovery effort: Overview and update for 2006**
Martinez, Cynthia*[1]; Wullschleger, John[2]; Sjoberg, Jon[3]. (1-U.S. Fish and Wildlife Service, Nevada; 2-National Park Service, Water Resources Division; 3-Nevada Department of Wildlife).

The Devils Hole population of Devils Hole pupfish (Cyprinodon diabolis) has been declining since 1995 and count data indicate that numbers are currently lower than at any other time during the 33-year period of record. Despite the existence of a large number of studies of the species and its habitat, the factors that are responsible for the ongoing decline remain unclear. In the absence of a good understanding of limiting factors within Devils Hole, the near-term strategy adopted by the agencies emphasizes measures to expand refuge populations and the reinitiation of captive propagation efforts. The limited geographic range of the species, lack of data on key life-history requirements, relative isolation of existing populations and facilities, shared jurisdiction, and limited dedicated resources have presented significant challenges to establishing a comprehensive conservation program. We summarize successes, failures and lessons learned over the past year, describe ongoing and upcoming actions, and discuss how the management agencies and cooperators are adapting to improve effectiveness as circumstances change and new information becomes available.

13:45 **Devil's Hole pupfish (*Cyprinodon diabolis*) refuge management**
Barkstedt, Judith*[1]; Heinrich, Jim[1]; Bower, Mike[2]; Webber, Grant[3]. (1-Nevada Department of Wildlife; 2-National Park Service, Death Valley National Park; 3-U.S. Fish and Wildlife Service, Nevada).

The three refuges established for the Devils Hole pupfish—School Springs, Hoover Dam, and Point of Rocks—have performed erratically because of inadequate design, mechanical failures, stochastic events, the small size of founder populations, and logistical difficulties of performing management in remote locations. However, these refuges are the only habitats outside of Devil's Hole that have been able to support self-sustaining populations of this species for some length of time. The School Springs refuge was constructed in 1973, endured many mechanical failures of the water delivery system, and has not been in operation since February, 2003. The Point of Rocks refuge, while having a reliable water supply system, has been prone to accidental species introductions including another pupfish species, Cyprinodon nevadensis mionectes, an exotic snail, Melanoides tubuerculatus, and an exotic crayfish. The accidental introduction of the snail

also occurred at the Hoover Dam refuge, adding to the refuge's problematic history, which includes high water temperatures, system malfunction, and flash flooding events. Both the Point of Rocks and Hoover Dam refuges were drained and dried to eradicate the invasive snail. The Point of Rocks fish are all hybrids, and are currently housed at the Mandalay Bay Shark Reef and Willow Beach National Fish Hatchery. All 18 fish from the Hoover Dam Refuge, which most recently held the only refuge population of Devil's Hole pupfish, have been moved to Willow Beach NFH for captive propagation. The Point of Rocks and Hoover Dam refuges will be given a period of time to re-inoculate with primary producers and zooplankton and made available for reintroduction of fish in the future.

14:00 **Changes in genetic structure of captive stocks of desert pupfish**

Koike, Haruko*[1]; Echelle, Anthony A.[1]; Loftis, Dustin G.[1]; Van Den Bussche, Ronald A.[1]. (1-Oklahoma State University, Department of Zoology).

The once widely distributed Desert Pupfish complex comprises two species, the Desert Pupfish (*Cyprinodon macularius*) and the Sonoyta Pupfish (*C. eremus*). For management purposes, refuge stocks of these species have been maintained since the 1980s at a variety of state and federal installations and private parks. Our analysis of variation at 7 microsatellite DNA loci in 20 refuge stocks of *C. macularius* and 5 stocks of *C. eremus* indicate conistently large declines in allele diversity in comparison with the wild source populations. For *C. macularius* the decline in some local refuge populations occurred prior to their establishment. Allele composition in such populations is similar to that of the originally founded captive stock that was used as a source for other refuge stocks. This indicates that declines in genetic diversity occurred either during the original founding from the wild or subsequently but prior to establishment of additional stocks. Allele diversity in local refuges is higher when there are records of establishment from two captive sources that were independently initiated from wild stock. We will discuss associations between changes in genetic structure and number of founders, habitat size, time since founding, and number of known founding events for each population.

14:15 **Hybridization of Devils Hole pupfish: insight and opportunity**

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

In 2004 biologists noticed pelvic fins on some individuals of *Cyprinodon diabolis* inhabiting the Point of Rocks refuge. Genetic analysis of individuals using microsatellite markers revealed that hybridization had taken place between *C. nevadensis* and *C. diabolis* in the pool. Estimates of fitness for three genotypes at one diagnostic locus revealed that the relative fitness of *C. diabolis* in the refuge was zero. These results, when viewed in the light of theory and estimates of fitness of hybrids and pure *C. diabolis* fish from hatchery rearing, suggest that *C. diabolis* may suffer from an enormous load of deleterious mutations. The existence of hybrid fish opens up the possibility of using introgression as a tool for genetic rescue of populations that have suffered dramatic and prolonged population bottlenecks.

14:30 **Conservation of the endangered Devils Hole pupfish through captive propagation efforts**

Webber, Grant*[1]; Bower, Michael[2]; Figiel, Chester[3]; Valdez Gonzalez, Arcadio[4]; Jewell, Jewell[5]; Scott, John[3]. (1-US Fish and Wildlife Service, S. Nevada; 2-National Park Service, Death Valley; 3-USFWS Willow Beach Harchery; 4-Universidad Autonoma de Nuevo Leon, Monterrey; 5-Shark Reef at Mandalay Bay, Las Vegas; 6-Shark Reef at Mandalay Bay).

The population status of the Devils Hole pupfish (Cyprinodon diabolis) has been in continuous decline since 1995 due to unidentified causes. In spite of months of effort, both in and out of Devils Hole, the population number continued to decline to it lowest number on record. In May 2006, 80 hybrid pupfish (Cyprinodon diabolis x Cyprinodon nevadensis mionectes) from the Point of Rocks Refugium were brought into captivity in an effort to test transportation and propagation protocols established for Devils Hole pupfish. After successful transportation and propagation of those hybrids, a total of four Devils Hole pupfish were transported to Shark Reef at Mandalay Bay, located in Las Vegas, Nevada, from Devils Hole (2 males) and the Hoover Dam Refugium (2 females). Propagation efforts were expanded to also occur at the Willow Beach National Fish Hatchery. The goal of the propagation effort is to conserve the pupfish and prevent its extinction by increasing the total number of Devils Hole pupfish through captive spawning in aquaria. The knowledge gained from both previous efforts, and more recently, efforts at Shark Reef and Willow Beach National Fish Hatchery have successfully produced Devils Hole pupfish in captivity. All progeny produced from propagation efforts will be managed according to a Devils Hole pupfish Genetics Management Plan.

14:45 **Devils Hole pupfish (*Cyprinodon diabolis*): an update on efforts in Devils Hole**

Bower, Michael R*[1]; Martinez, Cynthia[2]; Sjoberg, Jon[3]; Webber, Grant[2]; Wullschleger, John[4]; Hobbs, Brian[4]. (1-National Park Serviice, Death Valley National Park; 2-US Fish and Wildlife Service, Nevada; 3-Nevada Department of Wildlife; 4-National Park Service, Water Resources Division).

The only native population of Devils Hole pupfish has been declining for ten years. In the last two years the population has reached a level that is considered critically low. Though significant work has been done to understand the ecosystem of Devils Hole, the causes of the current decline remain unclear. We provide an update on population status, discuss current hypotheses on the causes of the decline and summarize recent, ongoing, and planned future activities in Devils Hole, Death Valley National Park.

15:00 **Preliminary results of temperature effect on the reproduction of four pupfish (Cyprinodontidae) from hot water springs**

Valdés Gonzalez, Arcadio*[1]; Angeles Vileda, Maria Elena[2]. (1-Lab. de Acuacultura, FCB UANL; 2-Lab. de Acuacultura, FCB UANL).

The culture of pupfish from hot water springs has proven difficult for most people attempting to maintain long-term breeding populations. It has been suggested that some taxa may represent phenotypes caused by high temperature environments altering

genotypic expression. In order to gain a better understanding of this situation, we are raising fish from hot water springs and nearby populations from cooler environments at different temperatures (26 to 40^oC) and comparing them meristically and morphologically. Study populations include *Cyprinodon pachycephalus* from San Diego de Alcalá (Chiuhahua), which lives at 38 to 40^oC; an undescribed pupfish, *C. cf. pachycephalus* ssp. "Julimes", from nearby Julimes Hot Spring (42 to 46^oC), *C. eximius* from the nearby Chuviscar River (low teens to 28^oC), and *C. bobmilleri* from the San Ignacio Hot Springs, at Linares (Nuevo León; 32 to 34^oC). Fish were paired in twenty-gallon aquariums and observed for ten for acclimation prior to actual egg counts for fourteen days. Three yarn mops were set in each aquarium and checked daily. Fish were fed at satiation with Tetramin flake food first thing in the morning and enough mosquito larvae to last through the day. *C. pachycephalus* laid 0-42 eggs and produced 136 eggs, of which 118 hatched; *C. cf. pachycephalus* ssp. "Julimes" laid 0-39 eggs and produced 289 eggs, of which 243 hatched; *C. eximius* laid 0-67 eggs and produced 403 eggs, of which 353 hatched; and *C. bobmilleri* laid 0-12 eggs per day and produced a total of 37 eggs, of which 31 hatched. No reproduction occurred below 26 oC, suggesting that temperature is a decisive factor for reproduction onset and egg production. *C. eximius* was the most productive species, followed by *C. cf. pachycephalus* ssp. "Julimes". In the overall 18-100 percent of fertile eggs were observed on all of the tested populations. Also important to know is that in a second set, one couple of *C. bobmilleri* only produced 11 eggs in one day, and for the rest of the experiment they did not produce any more eggs.

15:15 **California Bioregion Report**

Parmenter, Steve*[1]; Russi, Terry[2]; Potter, Covey[1]; Yoshioka, Glenn[1]. (1-California Department of Fish and Game; 2-Bureau of Land Management).

Owens pupfish were lost from Warm Spring; total populations are now down to 4 (two large and 2 small). Owens tui chub (OTC) stable; genectic study reported in J. Conserv. Genet. BLM created a second pond at Mule Spring for the highly imperiled toikona subset of OTC. Restoration of Owens Valley Native Fishes Sanctuary has begun, using 2003 BLM Spring restoration as a model. To date the upper dam has been permanently breached and the lower dam has been equipped with a concrete flume which will allow installation of a future low head fish barrier. Water level has drained to the natural level, and the northern spring vent is again rheocrene. Mohave tui chub is stable with four populations in refuges and a small captive stock in Tucson. Desert pupfish

15:30 **Is predator avoidance learned or hard-wired?**

Ward, David L.*[1]; Hunt, Teresa A.[1]; Figiel, Chester[2]. (1-Arizona Game and Fish, Research Branch; 2-Willow Beach National Fish Hatchery).

Native fish reared in hatcheries typically suffer high predation mortality when stocked into natural environments. We subjected hatchery reared razorback suckers, *Xyrauchen texanus*, and wild caught, but predator naïve, sonora suckers, *Catostomus insignis*, roundtail chub, *Gila robusta*, and fathead minnows, *Pimephales promelas*, to predation by flathead catfish, *Pylodictis olivaris*, in a natural pond setting. After 3-6 days, prey fish were removed from the pond and used in laboratory tests designed to evaluate

differences in behavior between fish with previous predator experience and those without. In the first part of the study we found that razorback suckers and sonora suckers were highly vulnerable to predation by catfish with over 75% of the individuals being consumed within 6 days, whereas fathead minnow and roundtail chub experienced 40% and 5% mortality respectively. Laboratory tests indicated that there may be differences among species in their ability to learn to recognize predators and that juvenile razorback and sonora suckers do not inherently recognize flathead catfish as a threat. Predator recognition training for native fish reared in hatcheries may be a potential management tool but many questions about effectiveness and implementation still need to be answered.

15:45 **Benefit of physical exercise on escape performance and preliminary testing of predator avoidance in razorback sucker (*Xyrauchen texanus*).**
Mueller, Gordon A.*[1]; Carpenter, Jeanette[1]; Figiel, Chester[2]; Krapfel, Robert[2]. (1-USGS; 2-FWS).

Initially, naïve razorback suckers were attracted to large flathead catfish and exhibited no predator avoidance behavior. However, following a predation event, distribution shifted and sanctuary areas were used twice as often as those containing predators (36% to 64%; n = 50: 33% to 67%; n = 12). A more stringent test based on weighted usable (sanctuary) area; indicated smaller sanctuaries were used 6 times more often following a predation event. Experiments suggest predator avoidance by razorback sucker is a learned behavior. Razorback suckers exercised (treatment) in current (<0.3 m/s) for 10 weeks exhibited greater swimming performance (6.7% in Ucrit cm/s; $p = 0.171$) compared to control fish. More importantly, treatment fish experienced a 22% greater survival rate ($p = 0.046$) compared to control fish when subjected to flathead catfish predation. Work for 2007 will examine the benefits of combining both exercise and learned predator avoidance for razorback suckers and we hope to expand these tests to include trials for bonytail (Gila elegans). Our goal is to determine if physical and behavioral conditioning will improve short-term stocking survival.

16:00 **Least chub: Recovery through aquaculture research and refuge populations**
Mills, Michael D.*[1]; Wagner, Eric[1]. (1-Utah Division of Wildlife Resources).

Least chub (*Iotichthys phlegethontis*) is a small minnow endemic to the Bonneville Basin of Utah where it was historically widely distributed. Currently the species is restricted to a few isolated spring complexes and ponds. Recovery of least chub has focused on preserving genetic diversity and range expansion through the establishment of refuge populations. Research on optimizing spawning success, growth, and survival was conducted to guide efforts to establish refuge populations. Growth was maximized at 22.3 degrees Celsius and a diet consisting of marine algae and *Artemia* provided for better fry survival and growth. Additionally, both growth and survival were greater in simulated ponds than in aquaria. Seven least chub refuge populations have been established. Two of these populations are located in state owned hatcheries, while the reaming five are wild populations located in ponds and wetlands. In combination with minimizing threats imposed on natural populations, these efforts have prevented further declines and federal listing of the least chub.

16:15 **Native fishes back into historical streams in east-central Arizona**

Avenetti, Lorraine D.*[1]; Robinson, Tony[1]; Fulmer, James[1]. (1-Arizona Game and Fish Department - Research Branch).

Native Apache trout, *Oncorhychus gilae apache*, only exist in the headwaters of Little Colorado River and Salt River Drainages, east-central Arizona are making a come back from severely low numbers in the late 1800s. Native fish assemblages in Arizona were drastically altered before the 1800s. These alterations include building of dams, diverting water, land use practices, and introduction of nonnative fishes. Our study involves re-establishing native fish assemblages in streams that have a fish barrier and have been renovated for Apache trout and to evaluate survival and recruitment to adult population of species we put into these streams. Our attempt is to stock enough fish to ensure genetic diversity, avoid a founder effect, and minimize extinction risk with too few individuals. By restricting transportation of a fish to within a stream or the immediate area of its mouth will alleviate the concerns of inter-basin transfer of parasites, diseases, and genetics. However, for species that were historically but not currently present in a stream, it will be necessary to capture fish from near by streams. In these cases, a sample of fish (30 of each species) will be collected and analyzed for parasites and disease. The species we are reintroducing include Speckled dace, *Rhinichthys osculus*, Blueheaded suckers, *Catostomus discobolus*, Little Colorado suckers, *Catostomus* sp., Desert suckers, *Catostomus clarki*, and Little Colorado Spinedace, *Lepidomeda vittata*.

We reintroduced in the summer 2005, speckled dace back into Snake Creek located off the Black River. In October 2005, we put speckled dace into Bear Wallow Creek. On Snake creek we conducted a single pass electrofishing survey and found one speckled dace. Bear Wallow Creek has not been surveyed yet and will be done this fall, 2006.

We have conducted three native fish health assessments (Little Colorado River, West Fork Black River and main stem of the Black River) in 2006. According to the reports from USFWS California Nevada Fish Health Center, bacteria, Red Mouth, *Yersinia ruckeri*, was found in speckled dace from the Little Colorado River. On the main stem of the Black River, the Virology report found a Reovirus in speckled dace. We will not be using these areas for a source to move fish from. The West Fork of the Black River is going to be a source stream and we are moving fish from there this fall, 2006.

16:30 **Roundtail chub (*Gila robusta*) brood and propagation program**

Cantrell, Chris J.*[1]. (1-Arizona Game and Fish Department).

Arizona game and Fish Department (AZGFD) developed a Statewide Conservation Agreement and Strategy (SCAS) for roundtail chub (*Gila robusta*), headwater chub (*Gila nigra*), flannelmouth sucker (*Catostomus latipinnis*), Little Colorado River sucker (*Catostomus spp.*), bluehead sucker (*Catostomus discobolus*), and Zuni bluehead sucker (*Catostomus discobolus yarrowi*). As a component of the SCAS, specific management opportunities for roundtail chub address factors leading to declines of this species and outline conservation actions that include minimizing or eliminating threats where feasible and re-establishment within to historic localities. Within the mainstem Verde River adult roundtail abundance has declined and issues (biological, social, and political) within the mainstem Verde River prevent many conservation actions from occurring. SCAS

conservation actions (4.4 Augment Populations) and (4.8 Expand subject species population distributions through transplant, augmentation (i.e., use of artificially propagated stock) or reintroduction activities) are two actions which could be implemented within the mainstem Verde River. This presentation takes the listener through the steps AZGFD took to plan a brood and propagation program, including a protocol for collection, transport, quarantine and disease treatment, maintenance, propagation and repatriation, genetic management, brood management, salvage efforts, growth rates, parasites detected, and future plans for these fish and their offspring.

16:45 **The role of captive refuge populations in the conservation and recovery of Gila topminnow and desert pupfish**

Voeltz, Jeremy B.*[1]; Duncan, Douglas K.[2]. (1-U.S. Fish and Wildlife Service (Formerly Arizona Game and Fish Department); 2-U.S. Fish and Wildlife Service).

Establishing and maintaining captive refuge populations of endangered desert fishes are important roles in many conservation and recovery programs. Under permit from the Arizona Game and Fish Department and the U.S. Fish and Wildlife Service, several cooperators such as Universities and other schools, museums, parks, and conservation groups, such as The Nature Conservancy, are holding endangered Gila topminnow, *Poeciliopsis occidentalis*, and desert pupfish, *Cyprinodon macularius*, as part of recovery efforts for these species. The refuge habitats vary from small, "backyard"-style water features, to larger sized ponds capable of supporting thousands of individuals of each species. In one case, captive establishment of a unique lineage of Gila topminnow in 2002 may have saved the population, as the population is now possibly extirpated in the wild. We will discuss the program, and provide examples of program components including genetic issues, nonnative species concerns, site security and size, monitoring, habitat maintenance, and the overall importance of maintaining captive stocks.

18:30 - 22:00 **EVENING DISCUSSION SESSION - Captive and Refuge Populations**
Location: Oasis Room at Furnace Creek Inn, located up on the hill to the east of Furnace Creek Ranch and the Visitor Center.

Sunday, 19 Nov. 2006

08:00 - **FIELD TRIP to Ash Meadows**
Location: Gather at the Visitor Center parking lot.