Desert Fishes Council

Consejo de los Peces del Desierto

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

49th Annual Meeting

Long Program

15-19 November 2017

Hotel Araiza

San Luis Río Colorado, Sonora, México

Frontispiece artwork by
Jose Campoy-Román

Desert Fishes Council
Overview and Event Locations

Wednesday, 15 November 2017	**Event**	**Location**
16:00 -18:00	Registration	Hotel Araiza
19:00-20:00	Social	Hotel Araiza
Thursday, 16 November 2017		
08:00-08:45	Welcome	Hotel Araiza
08:45-10:15	Lower Colorado River Symposium	Hotel Araiza
10:15-10:30	Break	Hotel Araiza
10:30 -12:00	General Session I	Hotel Araiza
12:00-13:30	Lunch	On your own
13:30-16:00	General Session II (Student Talks)	Hotel Araiza
16:00-17:30	Optional field trip	Museo Regional de San Luis Rio Colorado
17:00-18:00	Poster session	Hotel Araiza
18:00-20:00	Student mixer	Hotel Araiza
20:00-22:00	Group dinner	Hotel Araiza
Friday, 17 November 2017		
8:30-8:45	Awards presentation	Hotel Araiza
08:45-11:00	Rio Sonoyta Symposium	Hotel Araiza
11:00-11:30	General Session III	Hotel Araiza
11:30-12:00	Local student presentations	Hotel Araiza
12:00-14:00	Lunch	On your own
14:00-15:30	General Session IV	Hotel Araiza
16:00-16:15	Informal Yaqui discussion	TBA
16:00-17:30	Optional field trip	Museo Regional de San Luis Rio Colorado
17:30-19:00	Business meeting	Hotel Araiza
19:00-21:00	Banquet	Hotel Araiza
Saturday, 18 November 2017		
8:00 – 17:00	Optional field trip	Pinacate Biosphere Reserve
8:00 – 17:00	Optional field trip	Cienega de Santa Clara/El Doctor wetlands

Meeting Venue

Hotel Araiza
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Long Program (date, time, author(s), title, abstract)

Presenters, please load your presentation by 6:00 pm the day before your presentation.

Presenters have an asterisk next to their name
Student award presentations are in blue font

WEDNESDAY 15 NOVEMBER 2017

2017-11-16 13:00-18:15 **Registration**

2017-11-16 19:00-20:00 **Social**

THURSDAY 16 NOVEMBER 2017

2017-11-16 08:00:00 Opening Remarks

2017-11-17 8:45- 12:00 General Session I, Lower Co. River Symposium: Scott Bonar, Moderator

2017-11-16 8:45: Dale Turner: The Colorado River Delta and Estuary: What It Was and Could Be

The Delta of the Colorado River is an ecosystem of global importance, where a major river meets the sea in one of the world's most arid regions. Before most of its flow was diverted for upstream uses, the river brought fresh water and nutrients to the Gulf of California, provided nursery habitat for marine species, created nesting and feeding habitat for millions of birds, and formed a critical passage for wildlife and people. The Delta and its estuary have lost many ecological functions due to changes in the river hydrology, but still remain important for fish, birds, and people. I will present a brief natural, cultural, and scientific history of the Delta, along with an overview of recent conservation efforts and prospects for its future.

2017-11-16 9:15: Sharon Keeney: Status, conservation and management of the desert pupfish, *Cyprinodon macularius*, in California

The desert pupfish (*Cyprinodon macularius*) is an endangered species that historically was abundant in portions of southern Arizona, southeastern California, northern Baja California, and Sonora, Mexico. In the Salton Sink area of California, extant natural populations of desert pupfish occur in San Felipe Creek, Salt Creek, an unnamed wash (often referred to as Hot Mineral Spa Wash) south of Bombay Beach, irrigation drains of the Salton Sea, the Salton Sea proper, and its associated shoreline pools and ponds. Major threats to natural populations include invasive species, climate change, water management and development for human use, the associated reduction of water quantity and quality in the Salton Sea, its tributaries, and other desert pupfish habitats, and the loss of habitat connectivity. California Department of Fish and Wildlife has been working with cooperating entities, including conservation partners associated with the Coachella Valley Multi-Species Habitat Conservation Plan, to implement tasks identified in the Desert Pupfish Recovery Plan. San Felipe Creek, the only designated critical habitat for desert pupfish, and Salt Creek typically have had abundant desert pupfish populations, but recently we observed drastically reduced flows in these creeks. In 2017, most of San Felipe Creek, dried completely by early summer. This loss of water included the perennial reach that has been monitored since 1993, with no previous observations of desiccation. We salvaged several hundred desert pupfish and translocated these fish to other habitats in late May and early June. Bureau of Land Management, California Department of Fish and Wildlife, and U.S. Fish and Wildlife Service are investigating the possible causes of the acute and sudden reduction in flow, but activities of various water users, climate change, invasive vegetation, and seismic activity may have contributed to the loss of water. Immediate management needs include habitat restoration and also continuous monitoring of water quality and water levels in San Felipe Creek. On the eastern side of the Salton Sea, recent changes to the hydrology have affected Salt Creek and the rest of the Dos Palmas Conservation Area. Possible factors contributing to the acute reduction in streamflows include the Coachella Canal lining, which is part of the Quantification Settlement Agreement (QSA), drought, climate change, and invasive vegetation. The reduced flows have also resulted in poor water quality in some habitats during the summer months, including salinities much higher than those previously observed in a particular section of upper Salt Creek. This necessitated the capture and translocation of most of the pupfish to upstream ponds at Dos Palmas and other habitats in 2016 and 2017. We are considering potential sources of additional water for Salt Creek during summer months, but we will likely continue to salvage and translocate desert pupfish annually until additional water can be secured. Habitat restoration is also being planned for Salt Creek. In Hot Mineral Spa Wash and some of the irrigation drains, desert pupfish populations are stable and sometimes abundant, with relatively consistent and adequate water quantity and quality. However, some of the irrigation drains and shoreline pools that once provided excellent desert pupfish habitat are now dry or have very little water. Desert pupfish still occur in the Salton Sea, particularly Varner Harbor where salinity is lower (40 ppt compared to approximately 60 ppt), but the salinity of the sea will increase in 2018 when Imperial Irrigation District stops providing mitigation water per the requirement of the QSA. Desert pupfish refuges include ponds at Anza-Borrego Desert State Park (2), Borrego Springs High School (1), Oasis Springs

Ecological Reserve (1), Dos Palmas Preserve (4), University of California Riverside, Palm Desert (1), Imperial Irrigation District (1), and The Living Desert (3). Some refuge populations are stable to increasing, but others are extirpated or decreasing due to one or more causes, including failure of the water delivery system, drying of a spring, invasive species, vandalism, predation from raccoons and birds, and excessive shading. Restoration efforts led by Center for Natural Lands Management are still in progress at one former refuge, Simone/McCallum Pond (Coachella Valley Preserve). Management of these refuges include monitoring and maintaining genetic health of desert pupfish populations, annual vegetation control, removal of non-native fauna, maintaining the water source, and re-lining the pond bottoms. We received a grant to fund the construction of a new well for the second pond at Oasis Springs Ecological Reserve and hope to restock pupfish in late 2018. New refuges or other habitats currently being planned for desert pupfish include 25 acres of ponds (5 or 6) at the north end of the Salton Sea, at least two additional ponds at Dos Palmas Preserve, a small pond at Boyd Deep Canyon Desert Research Center, and two 320-acre ponds which are part of the State of California's Salton Sea Species Conservation Habitat Project (SCH) at the south end of the sea. However, since the primary objective of SCH is to provide forage fish for piscivorous birds, the ponds will not be desert pupfish refuges. We have been working with Coachella Valley Mosquito and Vector Control to eventually stock desert pupfish for mosquito control in private ponds, especially larger habitats near the Salton Sea.

2017-11-16 9:30: Martha Román-Rodríguez*, María Guadalupe Valdez-García, Alejandra Calvo-Fonseca, Gorgonio Ruiz Campos and Alejandro Varela-Romero: Population status of the desert pupfish (*Cyprinodon macularius*) in wetlands of the Reserva de la Biosfera Alto Golfo de California y Delta del Río Colorado

As part of the Protected Natural Areas Management Program, the Biological Monitoring Program of the desert pupfish (*Cyprinodon macularius*) was developed with the purpose of strengthening the conservation of this priority species for the Upper Gulf of California and Colorado River Delta Biosphere Reserve, by assessing their populations, current distribution, habitat conditions, threat determination, and conservation opportunities. To accomplish this objective, systematic sampling was carried out from August to November 2016 in 10 different localities of the Ciénega de Santa Clara and El Doctor wetlands. Sampling of the fish was carried out using minnow traps with a dwell time in the water of 6 to 24 hours, after which a review and in-situ processing of the specimens of pupfish return them alive at the capture site. The by catch fauna was collected for further processing. To perform the physicochemical evaluation of the habitat were recorded the variables of temperature, salinity, dissolved oxygen and pH in each of the collection sites. The pupfish was present in 4 of the 10 sampled localities, La Palma, Los Pinos and Espejo de Luna in the springs of El Doctor and one more in the Flor de Desierto-Cienega de Santa Clara. The most abundant species during the sampling period was the exotic fish *Poecilia latipinna* (40.69%) vs 21.93% of the pupfish fish. Only in one locality (Flor del Desierto) pupfish was the dominant species (.83%). The average size of the pupfish was 3.1 cm of total length, the proportion between males and females was 1: 2.2. The growth in *C. macularius* is allometric positive W=0.0276L2.7, the highest condition factor (30.46) was obtained for individuals captured in the locality Flor del Desierto and generally higher during the summer months. It was confirmed as cited in previous studies

that the distribution and abundance of pupfish maintains fluctuations in the sampling area that depend on the dynamics of the hydrological system of the sites for the permanence of marginal areas of flood as an ideal habitat for *C. macularius*. Degradation of habitat by anthropogenic activities and the invasion of exotic fish species, especial, continue to be the main threat to the permanence of pupfish in the wetlands of the Reserve. It is advisable to initiate a Recovery Plan of the species as well as eradication of exotic species as well as creation of refuges into the Reserve wetlands in order to promote and ensure the permanence of the species in the Colorado River Delta

2017-11-16 9:45: Tomas Enrique Rivas Salcedo: Monitoring of fish and zooplankton in the Rio Hardy-Colorado delta and estuary, from 2009 through 2017

Se presentan los datos de monitoreo de peces en siete puntos de los ríos Hardy y Colorado y en tres puntos de monitoreo de zooplancton de la zona estuarina y el río Colorado. Los monitoreos cubren un periodo de siete años en ambos casos, donde se registraron parámetros fisicoquímicos del agua al momento de cada monitoreo. El monitoreo de peces se realizó de manera mensual en los primeros tres años y estacionalmente los recientes cuatro años con chinchorro, donde se registraron un total de 34 especies de peces y tres especies de crustáceos, siendo la especie más abundante *Elops affinis* (machete o chiro). En el caso de zooplancton, el monitoreo se enfocó inicialmente en el registro de postlarvas de camarón que ingresaban a la zona estuarina, pero posteriormente se incluyó también en el análisis a los huevos y larvas de peces. Los monitoreos se realizaron con arrastres de red de plancton por cinco minutos y se registraron dos especies de camarón, *Litopenaeus stylirostris* (camarón azul) y *Farfantepenaeus californiensis* (camarón café), siendo más abundante el camarón café tanto en la zona estuarina como en el río. Entre el ictioplancton registrado, se encuentran huevos y larvas de *Cynoscion othonopterus* (curvina golfina) y huevos, larvas y adultos de *Gillichthys detrusus* (chupalodo del delta).

2017-11-16 10:00: María Guadalupe Valdez-García and Martha Román-Rodríguez: Evaluation of water quality as a determinant of desert pupfish (*Cyprinodon macularius*) survival in La Flor Del Desierto- Cienega de Santa Clara, Sonora, Mexico

La Ciénega de Santa Clara es el humedal más extenso en el Delta del Colorado y forma parte de la Reserva de la Biosfera Alto Golfo de California y Delta del Río Colorado. La parte noreste de ésta es refugio importante para el Pez Cachorrito del Desierto (*Cyprinodon macularius*). Como parte de la estrategia de conservación ¨in situ¨ se considero hacer un monitoreo biológico de la abundancia del Pez Cachorrito del Desierto y el análisis de las variables fisicoquímicas del agua (Oxígeno, Temperatura, salinidad y pH) con el fin de evaluar la calidad de agua del humedal y realizar un comparativo del comportamiento de las variables fisicoquímicas y la relación que existe entre éstas y la abundancia del pez en este sitio. Lo anterior con el propósito de identificar posibles factores de estrés en el sistema acuático que influyan en la permanencia y abundancia del pez dentro del humedal. Se realizaron muestreos mensuales entre los meses de Agosto y Noviembre 2016 en la zona de la Cienega conocida como Flor del Desierto. Para la captura de peces se utilizaron trampas tipo ¨minnow¨, el tiempo promedio de trabajo de trampa fue de 17 horas. El instrumento que se utilizó para la medicion de la variables fisicoquímicas del agua fue un equipo multiparámetros. De acuerdo a los datos obtenidos,

pez cachorrito del desierto es la especie dominante en esta localidad ya que estuvo en el 83% de las captura durante el periodo de muestreo. La segunda especie más abundante fue *Poecilia latipinna* y representó el 15% del total de las capturas. Las variables que influyen en la distribución y abundancia del pez cachorrito dentro del humedal son la salinidad y el oxígeno, ya que éstas son las que presentan coeficientes de correlación respecto a la abundancia del pez en más del 70%.

2017-11-16 10:15: BREAK

2017-11-16 10:30: Lesley Fitzpatrick: Lower Colorado River Report 2016-2017

Information voluntarily provided from state and federal agencies, contractors, and private individuals working on native fish and other aquatic animals in the LCR Basin will be presented. The LCR Basin includes the Lower Colorado River from Glen Canyon Dam to the Sea of Cortez, the Gila and Santa Cruz Sub-basins, the Virgin River Sub-Basin, the Rio Sonoyta and the Rio Yaqui basins (technically outside of the LCR). Results from ongoing and new management efforts will be presented as provided to the author.

2017-11-16 10:45: David Rogowski: Do desert fish have an image problem?

There are a variety of ways to measure popularity. Popularity can be measured by the number of Facebook friends, how many votes one garners in reality TV shows, political offices, and best restaurants. Popularity can be measured by how many times an item is purchased, books, and music. But how do you measure the popularity of fishes? People are utilizing the worldwide web to answer a variety of questions, with Google dominating the field. Wikipedia the free on-line encyclopedia is the fifth most visited web-site in the world. It is much easier to extract data and metrics from Wikipedia than a commercial site, such as Google. I used pageview analyses of Wikipedia to rank the most popular freshwater fishes in the English speaking world. Over 400 fishes, including sport fishes, ornamental fishes, native fishes as well as common freshwater invasive fishes from 2008 to 2016 were included in this analysis. While relative ranking of species varied over time, the top two rankings were for catfish and koi. Our native desert fishes ranked fairly low with the pupfish ranking only 110, Humpback Chub at 161 and Razorback Sucker at 177. Why do are native desert fishes relative ranks fairly low? Can we increase the visibility of our native desert fish and thereby increase pageviews?

2017-11-16 11:00: Anthony Robinson*, Kent Mosher and Kaleb Smith: Muleshoe Ranch Cooperative Management Area Native Fish Conservation

The Muleshoe Ranch Cooperative Management Area in the San Pedro River basin in south-central Arizona has been a focus of native fish conservation for over a decade. Native fish occupied five streams on the ranch, and only one stream had an incursion of nonnative fish; Green sunfish, *Lepomis cyanellus*, were low in abundance in Redfield Canyon. Three ponds and seven streams on the ranch were stocked with endangered native fish during 2007-2017. As of 2017, Gila Topminnow, *Poeciliopsis occidentalis*, is established in one pond and five streams, but failed to establish in one stream (Cherry Spring Canyon). Desert pupfish, *Cyprinodon macularius*, is established in two ponds and may be establishing in a third pond, but failed to establish in two of the streams where they were stocked. Spikedace, Meda fulgida, and Loach Minnow, *Rhinichthys cobitis*,

established in Hot Springs Canyon, but failed to establish in Redfield Canyon. Roundtail Chub, *Gila robusta*, was moved within Redfield Canyon upstream of a waterfall and established there. A barrier was constructed in Hot Springs Canyon to prevent the upstream incursion of nonnative fishes in that drainage, and a barrier is planned for Redfield Canyon for a similar purpose. Green sunfish have been mechanically controlled in Redfield Canyon, but after the barrier is in place, they can be eradicated upstream. The high level of successful native fish conservation is attributed to geography and the contribution of multiple agencies and private landowners.

2017-11-16 11:15: Paul Scheerer, Justin Miles, Jimmy Leal, Troy Brandt, Paul Devine, Stewart Reid and Kathryn Boyer*: Oregon / Northern California Area Report November 2017

The northwestern extreme of the desert region includes several endorheic drainage subbasins in Oregon, northeastern California, and northwestern Nevada (Fort Rock, Chewaucan, Goose, Warner, Catlow, Alvord, Malheur Lakes, Coyote Lakes, and Quinn). This region supports remnant fish faunas that once inhabited extensive pluvial Pleistocene lakes. Oregon Department of Fish and Wildlife (ODFW): 1) trapped the Warner lakes to assess Warner Sucker, *Catostomus warnerensis*, recruitment and abundance (and that of other native and nonnative fishes), 2) monitored movement of PIT tagged Warner Suckers to assess passage at a newly constructed, sucker-friendly fish ladder, 3) obtained a population estimate and evaluated habitat conditions for Foskett Speckled Dace, *Rhinichthys osculus* ssp., in Foskett and Dace Springs (in cooperation with BLM), 4) described the distribution and abundance of Pit sculpin in the Cottonwood Creek drainage (Goose Lake Basin), and 5) Redband Trout *Oncorhynchus mykiss* surveys in Deep and Twelvemile Creeks (condition and size structure; Warner Basin) and in tributaries to the Chewaucan River (assess potential culvert barriers). The Bureau of Land Management (BLM), with help from ODFW (salvage fish), continued ongoing habitat restoration at Foskett Spring for Foskett speckled dace and excavated pools and channels using a mechanical excavator. Lake County Watershed Council completed several passage projects including: 1) installing a rock ramp bypass channel at the MC Diversion on Twentymile Creek (Warner Basin) in collaboration with River Design Group, 2) replacing a culvert on Elder Creek (Chewaucan Basin), and 3) installing baffles to an existing fishway/screen at the Paisley Town Weir (Chewaucan Basin). The River Design Group (RDG) completed the following projects: 1) channel realignment on Upper Thomas Creek (restore sinuosity), 2) fish passage project at MC Diversion (worked with watershed council- see above), 3) fish screening at the Flood Ditch on Honey Creek (Warner Basin), 4) prepared a reconnaissance plan for potential fish passage projects in the Goose Lake Basin, 5) restored fish passage at the Simms Diversion on Crooked Creek (Warner Basin), 6) channel reconstruction on Jones Creek (Warner Basin), and 7) stabilized meadow head cuts on Jones Creek (Warner Basin). RDG is also working with stakeholders on the Warner Basin Strategic Action Plan to develop fish passage solutions for Warner Suckers (Warner Basin). The California Department of Fish and Wildlife (CDFS) conducted drought monitoring (stream flow and temperature) in three Redband Trout streams in the Goose Lake basin (Lassen, Cold, and Willow Creeks) that provide habitat for Goose Lake Redband Trout, Goose Lake Sucker, Goose Lake Lamprey, and Pit Sculpin) and six tributaries that provide habitat for Modoc sucker (Turner,

Washington, Coffee Mill, Hulbert, Dutch Flat, and Johnson Creeks). Given a better water year, all streams appeared to be in good condition following the extreme drought conditions observed in 2014-2015. CDFW also collected tissue samples for genetic analysis of Eagle Lake Rainbow Trout (ELRT) to evaluate genetic diversity and inbreeding related to the effects of artificial propagation of this native strain and to evaluate genetic uniqueness of extant "resident" upper Pine Creek populations. Assessed spawning movements of 119 pit-tagged ELRT in Pine Creek and documented movement of two fish to the headwater spawning area. Conducted an assessment of Pine Creek headwaters for Brook Trout distribution and (planning) and ongoing removal efforts. Stewart Reid, Western Fishes, 1) worked with the Pit River Tribes to describe the historical and current fish assemblage in the North Fork Pit River in NE California to guide future resource management, 2) noted good Modoc Sucker recruitment in 2017 and continued suppression of largemouth bass, 3) completed a new analysis of historical distribution of Pacific Lamprey suggesting they would have extended into the upper Pit and Klamath Rivers prior to the construction of dams in these systems.rnia Area Report, November 2017

2017-11-16 11:30: Carlos A. Ballesteros-Córdova*, Alejandro Varela-Romero, Gorgonio Ruiz-Campos, Lloyd T. Findley, José M. Grijalva-Chon and Luis E. Gutiérrez-Millán: GENETIC IDENTITY BY CHARACTER BASED DNA BARCODING OF A CRYPTIC SPECIES WITHIN THE *Gila eremica* LINEAGE IN SONORA NORTHWEST MEXICO

Fishes of the genus Gila inhabit freshwater systems in northwestern Mexico and southwestern United States and comprise a heterogeneus group of species with a complex taxonomic and systematic history. The Desert Chub, *Gila eremica* DeMarais 1991, is an endemic species in Sonora. Morphological and phylogenetic analyses of this lineage revealed isolated populations of *Gila cf. eremica*, recently discovered in the Arroyo El Tigre sub-basin of the Mátape River basin, as divergent in respect to other nominal *G. eremica* populations, and as a monophyletic group that shares a putative common ancestor with populations from the Mátape River basin. Results suggest that *G. cf. eremica* is a cryptic species within the lineage and that it requires genetic discrimination. Analysis of 83 COXI sequences of several Gila species from Sonora showed a total of nine haplotypes, none of them shared among *G. cf. eremica* and other nominal G. eremica populations. The *G. eremica* lineage, including *G. cf. eremica*, showed a haplotype and nucleotide diversity of 0.6093 (S.D. = 0.034) and 0.00125 (S.D. = 0.00112), respectively. The sequences of the taxa included in the DNA analyses showed 46 polymorphic sites. The character-based DNA barcoding analysis revealed seven pure characters discriminating populations of nominal *G. eremica* from its congener *G. purpurea* and eight to discriminate G. *cf. eremica* from *G. purpurea*, and one fixed character in *G. cf. eremica* to discriminate it from other nominal *G. eremica* populations. The presence of a fixed character for *G. cf. eremica* in contrast to other nominal *G. eremica* populations reveals an apomorphy within the lineage. Determination of genetic identity by diagnostic characters among G. cf. eremica and other *G. eremica* populations, along with recent morphological and phylogenetic evidence of divergence, supports the hypothesis of this cryptic species as a distinct biological/evolutionary unit apart from other populations of *G. eremica*.

2017-11-16 11:45: Kaleb Smith*, Tony Robinson and Kent Mosher: Evaluation of Spikedace and Loach Minnow Repatriation and Monitoring

Spikedace *Meda fulgida* and loach minnow *Tiaroga cobitis*, both listed as federally endangered in 2012, have extant populations in only a few streams in Arizona and New Mexico. Repatriations are the primary actions used to recover these species. Since 2007, these two species have been repatriated to a handful of streams in Arizona. Loach minnow have been repatriated in five streams: Redfield Canyon, Hot Springs Canyon, Fossil Creek, upper and lower Bonita Creek and an augmentation to an existing population in the Blue River. To date, the only repatriation where the species has successfully established a population is at Hot Springs Canyon. Upper Bonita Creek and lower Blue River are still to be determined, while Redfield Canyon and Fossil Creek have not been considered a success. Spikedace have been repatriated in six streams: Redfield Canyon, Hot Springs Canyon, Fossil Creek, Bonita Creek, Blue River and most recently in Spring Creek (Yavapai County). Currently, Blue River and Fossil Creek are considered a success with established populations. Redfield Canyon, Hot Springs Canyon, and Bonita Creek were not successful repatriations. Spring Creek is yet to be determined because the first stocking was in 2015. Since 2007 there have been 9,918 loach minnow stocked into repatriation streams, while only 453 individuals have been observed in post-stocking surveys. Also, 17,022 spikedace have been stocked while 5,337 have been observed in post-stocking surveys over the years. Success (population establishment) of these repatriations has been hard to judge because of the adherence to a strategy of annual stockings and difficulty in detecting individuals during monitoring. Potential threats to repatriated fish may include poor habitat, loss of habitat due to drought and piscivorous fish predation. Future repatriations will commence in potential new streams.

2017-11-16 12:00-13:30: Lunch—on your own

2017-11-17 13:30 – 16:00 General Session II, Student talks: Linn Montgomery, Moderator

2017-11-16 13:30: Drew Eppehimer*, Hamdhani and Michael Bogan: Can Treated Wastewater Reestablish Aquatic Communities in Desert Rivers?

The California Department of Fish and Wildlife (CDFS) conducted drought monitoring (stream flow and temperature) in three Redband Trout streams in the Goose Lake basin (Lassen, Cold, and Willow Creeks) that provide habitat for Goose Lake Redband Trout, Goose Lake Sucker, Goose Lake Lamprey, and Pit Sculpin) and six tributaries that provide habitat for Modoc sucker (Turner, Washington, Coffee Mill, Hulbert, Dutch Flat, and Johnson Creeks). Given a better water year, all streams appeared to be in good condition following the extreme drought conditions observed in 2014-2015. CDFW also collected tissue samples for genetic analysis of Eagle Lake Rainbow Trout (ELRT) to evaluate genetic diversity and inbreeding related to the effects of artificial propagation of this native strain and to evaluate genetic uniqueness of extant "resident" upper Pine Creek populations. Assessed spawning movements of 119 pit-tagged ELRT in Pine Creek and documented movement of two fish to the headwater spawning area. Conducted an assessment of Pine Creek headwaters for Brook Trout distribution and (planning) and ongoing removal efforts.

2017-11-16 13:45: Nathan Dorff* and Michael Bogan: Long-term impacts of wildfire on macroinvertebrate community structure in an arid-land stream

Wildfires are natural disturbances that shape terrestrial landscapes and can alter aquatic ecosystems. Wildfires followed by heavy rain cause debris flows and scouring, potentially compounding effects on aquatic systems. In 2011, the Horseshoe 2 Fire burned over 90,000 hectares in southeast Arizona and was followed by heavy monsoonal rains and subsequent flooding and scouring. We monitored the aquatic macroinvertebrate community at one affected stream, East Turkey Creek, for four years pre-fire and six years post-fire. Taxonomic richness was significantly reduced post-fire, while overall abundances of macroinvertebrates remained the same. We observed post-fire increases in relative abundances of certain r-strategist taxa. The most common pre-fire taxa (baetid mayflies and blackflies) remained common post-fire, while other taxa saw sharp declines in densities for at least 5 years post-fire. We also found that some taxa (e.g. glossosomatid caddisflies) experienced large increases in densities post-fire, as documented in other studies. We used non-metric multidimensional analysis to track community composition pre- and post-fire, and found that recovery to pre-fire community composition took around 4 years. With hotter and drier conditions predicted in the arid Southwest, more frequent and higher severity fires will occur. It is important to understand how these novel fire regimes will alter aquatic systems.

2017-11-16 14:00: Pilar Wolters*, David Rogowski and Alice Gibb: Geometric morphometric analyses of Razorback Sucker, Flannelmouth Sucker and their hybrids

Hybridization between two sucker species, Razorback Sucker and Flannelmouth Sucker, historically occurred but has been facilitated by habitat alteration by the construction of dams. The Razorback Sucker has since been listed as endangered because natural recruitment is rare. It is important for the recovery of the Razorback Sucker to be able to discern between young Razorback, young Flannelmouth Suckers, and young hybrids. The purpose of our study was to aid in the management and recovery of Razorback Suckers by identifying the length at which we could correctly classify Razorback Sucker, Flannelmouth Sucker, and their hybrids. Razorback Sucker and Flannelmouth Sucker were artificially spawned to produce four progenies: Razorback Sucker, Flannelmouth Sucker, Razorback Sucker female X Flannelmouth Sucker male hybrid, and Flannelmouth Sucker female X Razorback Sucker male hybrid. We conducted geometric morphometric analyses and used conditional inference trees to determine what length the four progenies' shapes begin to differentiate. We also used piecewise-linear models to determine how each progeny's shape changes with total length. There was no shape difference between the two hybrid progenies, so hybrids were pooled together for analysis. The results of our study showed that fish smaller than 137mm total length are difficult to differentiate by shape. We also showed that Razorback Sucker and hybrid shapes change differently with growth. With the information provided in this study, field biologists should be cautious when identifying suckers smaller than 137mm TL in the Colorado River Basin.

2017-11-16 14:15: Zach Nemec* and Scott Bonar: Through the fish's eye: Comparison of densiometer and inexpensive hemispherical photography to assess streamside canopy

The spherical densiometer is a common field tool that measures the overstory density, commonly known as canopy cover, of forested areas. This tool has been used in several fish habitat studies, stream surveys, and sampling protocols when assessing coverage of riparian vegetation over streams. Although densiometers are very effective they cannot visually document an ever-changing canopy. Hemispherical photography is another tool that has been developed to evaluate the forest canopy. Photographs are taken in an upward direction using a wide-angle lens and post processed with image-analyzing software. However, hemispherical photography systems are typically expensive (~$2,000-$8,000), time consuming, and highly susceptible to damage when used in aquatic environments. The purpose of this study was to develop an inexpensive, fast, and rugged hemispherical photography system that can be used in aquatic ecosystems without fear of damage of equipment. We obtained paired densiometer readings and hemispherical photographs using GoPro Hero 4 action camera at sites in the Verde River in central Arizona. We post-processed the photos using two different image editing software programs. The inexpensive hemispherical photography method we developed provided cover measurements which were correlated ($r = 0.8546$, $P < 0.05$) with densitometer measurements, but could also provide a visual record of the overstory (different plant species, and amounts). Hemispherical photography, with further development, will be a useful addition or alternative to densitometer measurements for measuring stream canopy.

2017-11-16 14:30: Jane Rogosch*, Julian Olden, Jonathan Tonkin, David Lytle, David Merritt and Lindsay Reynolds: Hydrologic drought favors non-native fishes in a changing climate

Fishes of the American Southwest are poised to be impacted by non-stationary changes in flow regimes driven by increasing water consumption and climatic alterations in temperature and precipitation. Population dynamic models play an important role to anticipate and respond to these looming conservation challenges. Here, we apply matrix population models as a heuristic framework to explore how mixed native and non-native fish communities respond to hydrologic extremes that include increasing drought frequency. The model is generically parameterized, but specifically applied to 7 fish species in the Upper Verde River, Arizona, USA. Flow-ecology relationships were integrated into the population models by allowing key vital rates to vary according to flow year types (flood, drought, and non-event years), and species dynamics were coupled in a single model by using density-dependent reproduction based on the biomass carrying capacity at the river reach scale. We validated model parameters by comparing population projections under the flow record to a long-term fish monitoring dataset (1994 – 2008), and then projected the model to recreate community response to increasing drought frequency observed over the past nine years (2009 – 2017). Model projections were moderately correlated with the long-term fish monitoring dataset, where 13 years had spearman correlation coefficients above 0.4 and seven of those years had strong correlations ($r > 0.8$). Droughts increased by 50% compared to the previous decade, with coincident increased abundances of non-native species such as Red Shiner (*Cyprinella lutrensis*) and Green Sunfish (*Lepomis cyanellus*) and decreased abundances of native

species such as Desert Sucker (*Catostomus clarkii*) and Roundtail Chub (*Gila robusta*). Increased drought conditions resulted in a projected shift in community composition to one increasingly dominated by non-native species. By integrating causal links between species biology and hydrologic variability, population dynamic models can increase our understanding of possible outcomes to environmental change.

2017-11-16 14:45: Brenda Vega-Rodríguez*, Héctor Espinosa-Pérez, Verónica Mendoza-Portillo, Luis Ayala-Pérez and Andrea Jiménez-Marín: Barcodes of invasive Lorcarids on aquatic ecosystems of México

Loricarids are native fish from the Orinoco and Amazon basins, and were imported to Mexico through ornamental fish trade. Wildlife highly abundant populations have been seen in the Grijalva-Usumacinta basin, and since 2011 they were also recorded in some hydrological systems in northern Mexico. These organisms are classified as invasive species because they displace and reduce native species populations. The identification of these fishes is complex because meristic and morphometric characteristics display very little variation. In addition, there is the suspicion of a possible hybridization among these species. The objective of this study was to analyze, through DNA barcoding, the taxonomy and distribution of the loricarids that inhabit three waterbodies of Mexico. DNA extraction was done with the DNeasy 96 Blood and Tissue purification kit of Qiagen®. A 655 bp segment from the 5' region of the CO1 gene was amplified with the FishF2_t1 and FishR2_t1 primers and sequences were compared with the GenBank database (through a BLAST nucleotide search). Collected organisms in Don Martin Dam, Coahuila, showed high similarity (92.3% al 93.8%) to *Pterygoplichthys anisitsi*; specimens from Lacantun river, Chiapas, had a higher similarity (87.9% al 98.1%) to Pterygoplichthys pardalis.While specimens from Pom lagoon, Campeche, were observed to have higher similarity (91.3% al 97.6%) to *Pterygoplichthys pardalis* and others with *Hypostomus plecostomus* (90.5% al 95.9%).

2017-11-16 15:00: Betsy Grube*, Floyd Gray and Peter Reinthal: Inorganic Contaminants and Stable Isotopic Food Web Analyses of Bioaccumulation in Aquatic Communities in Southern Arizona

In the arid southwest, Acid Mine Drainages (AMD) alter watershed characteristics via input of acidic and metal-laden waters from abandoned mines and tailings. In the Santa Cruz River watershed, many geologic workings, tailings, and drainages periodically discharge metal-rich, acidic water, and leachates into surrounding systems. Most research focuses on single species responses to individual elemental contaminants. Here we combine contaminant and stable isotope analyses to look at bioaccumulation of multiple contaminants and food web dynamics in desert streams and lakes. We examine contamination of seven toxic metals (arsenic, cadmium, copper, mercury, lead, selenium and uranium) in samples of invertebrates, and sport and native fish species using both muscle and liver tissues collected in the Upper Santa Cruz watershed, Patagonia Lake, and Pena Blanca Lake. We determine food web structure using stable carbon and nitrogen isotopes. By combining these analytical methods with regression and multivariate methods, we present a novel approach of testing whether metal contamination occurs from consumption of different food resources or through

bioaccumulation. We find community level responses to a suite of contaminants. Our results indicate that there is great variation in different contaminants in both invertebrate and fish species. Contaminants accumulate in different species primarily due to alternate resource utilization as indicated by ‰ C. However, some species at higher trophic levels (> 4 ‰ N) demonstrate a trophic expansion to the consumption of a wider range of food items in degraded low pH, high metal systems. These results support the conclusion that impacts from degraded systems (low pH and high metals) are not just species specific but that trophic interactions among species and food web dynamics are significantly altered.

2017-11-16 15:15: Larissa Lee* and Scott Bonar: Using USGS StreamStats to evaluate relationships between fish populations and flow regime

Conserving the natural flow regime of streams is critical to safeguarding the diversity of native fish species throughout river systems. To understand the relationship between fish species and flow regime, scientists have used stream flow statistics based on USGS gage stations to characterize streams and compared these statistics to the relative abundance of species in these streams. In Arizona's streams, fish populations and flow can vary significantly throughout a single river, and these statistics may not represent the diversity of flows and fish populations found throughout each stream. The USGS program StreamStats uses regional regression models to create flow-related statistics for a precise location in a stream based on drainage area. Our research uses these statistics and relative abundance of fish species at precise locations to examine relationships between StreamStats statistics and fish populations within Eagle Creek, AZ. StreamStats statistics analyzed included peak 2-year flow, peak 10-year flow, and peak 100-year flow. This information can provide critical information to managers on how flow dynamics interact with different fish species in arid-land rivers. Future research will expand these analyses to include three more mid-size Arizona streams.

2017-11-16 15:30: David Ward: Rid-a-fish: A new tool for eradication of aquatic nuisance species

The continued decline of native fish in the southwestern United States is largely attributed to negative interactions with introduced fishes. Attempts to remove nonnative fish from areas with natives are common, but success is limited because very few tools are available for managing invasive aquatic species. A new ammonia-based product called Rid-a-fish utilizes the relationship between pH and ammonia toxicity to eliminate gill breathing organisms from water. At high concentrations, ammonia is known to be toxic to a wide variety of aquatic species and yet ammonia is the natural product of fish metabolism and is naturally present in the environment at low levels. Natural bacteria in the environment rapidly convert ammonia to non-toxic nitrate which is utilized by plants. Rid-a-fish has been shown to be effective at eliminating unwanted fish, crayfish, snails and mussels in laboratory settings, but needs evaluation on larger scales in natural systems. We evaluated the effectiveness of Rid-a-fish for removal of invasive green sunfish *Lepomis cyanellus* in a 1,000 cubic meter pond below Glen Canyon Dam at Lees Ferry. A second field trial evaluated the effectiveness of Rid-a-fish for removal of mosquitofish *Gambusia affinis* in 20 replicated 3,000-liter stock tanks and in an 800 cubic meter pond on the El Coronado Ranch in Southern Arizona. In in all cases this new tool was effective at eradicating the populations of unwanted fish. Although further field

trials are needed, these initial tests indicate licensing and registration of this new fish removal tool may be warranted.

2017-11-16 15:45: Kent Mosher*, Anthony Robinson and Kaleb Smith: Blue River Native Fish Restoration Project

The Blue River Native Fish Restoration Project is a multi-agency effort focused on protecting and restoring the native fish assemblage within the Blue River drainage in eastern Arizona. The project was initially focused on the lower 19 km of the Blue River, from Fritz Ranch to its confluence with the San Francisco River, and consisted of three main components: construction of a fish barrier (completed in 2012), mechanical removal of nonnative piscivorous fishes, and repatriation and monitoring of federally listed warm-water fishes. Between 2009-2017, Arizona Game and Fish Department staff conducted 7 nonnative piscivorous fish removal efforts (Flathead Catfish, Channel Catfish, Common Carp, and Green Sunfish), 6 native fish stockings (2 Spikedace, 2 Loach Minnow, and 2 Roundtail Chub), and 6 post-stocking monitoring efforts in the lower Blue River. As of 2017, large-bodied piscivorous fish have not been detected in the lower Blue River for four years and Green Sunfish have not been detected for one year. Spikedace and Roundtail Chub have also established self-sustaining populations, and Loach Minnow abundance appears to be increasing following the 2011 Wallow Fire. Due to these successes in the lower Blue River, restoration efforts have expanded upstream to include the middle Blue River between The Box and McKittrick Creek. Roundtail Chub and Spikedace were stocked into the middle Blue River in 2016 and 2017, respectively, in efforts to expand the range of these species in the river. Roundtail Chub monitoring efforts in 2017 detected 57 Roundtail Chub in the middle Blue River; however, additional monitoring efforts are needed to determine if this population is establishing.

2017-11-16 17:00-18:00 POSTER SESSION

Hamdhani Hamdhani*, Drew Eppehimer and Michael Bogan: Water quality dynamics in an effluent-dominated reach of the Santa Cruz River, AZ

The Santa Cruz River system is one of several river systems in Arizona that have experienced groundwater declines and loss of perennial flow due to groundwater pumping and drought. Along with Gila River and Salt River, the Santa Cruz River currently has artificial, perennial reaches that are supported by effluent discharge from wastewater treatment plants. The return of perennial reaches has brought back habitat for numerous of aquatic and riparian taxa. However, since these reaches are artificially supported by effluent they no longer have a natural flow regime or natural water quality gradients. Little research has been conducted on the water quality gradients along these perennial effluent-dominated reaches. The objective of this study is to quantify physical and chemical water quality gradients downstream from the effluent outfall. Beginning in August 2017, we have collected water quality data (e.g. DO, pH, conductivity, nutrient levels) monthly from six reaches spaced ~2 miles apart along the effluent-dominated lower Santa Cruz River, and will continue to do so through 2019. Additionally, we will expand our study to include other effluent-dominated reaches of Santa Cruz, Salt, and Gila rivers, as well as reference streams unaffected by effluent input. The findings of this

study will help us understand how effluent can be used to restore perennial river habitats in arid climates, including habitat for native desert fishes.

Eliza Gilbert*, Robert Dudley, Tyler Pilger, Thomas Turner, Yvette Paroz, Carter Kruse, Joanna Hatt, Bryan Bakevich, Martha Cooper, Brock Huntsman, Colleen Caldwell, Timothy Frey, Megan Osborne: Native fish conservation and management in the upper/middle Rio Grande, Pecos River, Canadian River, Tularosa and Guzman basins, New Mexico during 2017

In 2017 research, conservation planning, habitat restoration, population augmentation and repatriation, and population monitoring by a number of federal, state, university, and private entities – such as Turner Endangered Species Fund, American Southwest Ichthyological Researchers, and The Nature Conservancy - greatly contributed to management of native fishes in New Mexico. In the Rio Grande (RG) Basin this included habitat creation for, and repatriation and augmentation of, RG Cutthroat Trout, the southernmost subspecies of cutthroat trout. Research on this subspecies secondary production rates (biomass accumulation) and water temperature variation identified a potentially shifting thermal bottleneck, important to consider as the climate continues to change. Other efforts in the basin focues on RG Chub (RGC) and RG Sucker (RGS) and has resulted in a multi-state, tribal, federal, and private entity Conservation Agreement for the two species. The plan is currently being finalized and includes repatriation. Collection of RGC and RGS tissues for assaying eDNA markers has resulted in a reliable and sensitive marker for RGC while development is ongoing for RGS. Considering both species are wide-ranging and there is limited information on their distribution, life history, and habitat needs, the development of these markers will greatly assist in the species' conservation. Habitat restoration for both species is occurring in the RG and Guzman basins, which is some places is also benefitting Longnose Dace, Chihuahua Chub, and Chihuahua Leopard Frog. The RG Sucker is wide-ranging in New Mexico and population monitoring and genetic analysis shows a high level of diversity and evidence for historical transcontinental introductions. Two decades of systematic sampling for the RG Silvery Minnow (RGSM) in the middle RG Basin continues to document fluctuations in this imperiled species. However, 2016 sampling resulted in one of the highest density estimates and ecological modeling revealed that changes in density were reliably predicted by river flows with extended high flows crucial in explaining elevated RGSM densities and low summer flows, low levels of occupancy. Genetic effective size also increased in 2017 reflecting the greater population stability from 2016-2017. The small, endorheic, Tularosa Basin has the White Sands Pupfish, for which a new monitoring protocol has been developed and implemented. The basin also has Longnose Dace. Surveys in Tularosa Creek document the species continued presence. Two rare minnows, Peppered Chub and Arkansas River Shiner, are found in the Arkansas River of the Canadian River Basin. A Species Status Assessment which will consider both species is currently underway and population and genetic monitoring continues. In the upper portion of the Canadian River Basin riparian restoration and fish assemblage monitoring is occurring in conjunction with partnering universities. In conjunction with high school students, genetic data from RG chub populations in Rio Mora, a Canadian River drainage stream, is being assessed to determine whether this population shows a greater affinity to the Canadian or Pecos River drainage. Barrier upgrades and construction in

the Pecos River Basin is protecting native fishes from Sheepshead Minnow invasion. After five years, of translocating Gray Redhorse into the Pecos River Basin's Delaware River reproduction and recruitment to the juvenile life-stage has been documented. Water intermittency and temperature data loggers were installed in the Delaware River. These will provide habitat information allowing managers to effectively support and sustain this repatriated population.

Earyn Mcgee*, Noel Hamideh, Rezwana Islam and Michael Bogan: Linking Perennial Surface Water and Aquatic Food Subsidies to Lizards in Arid Environments

Severe drought driven by climate change and water use by humans is causing formerly perennial streams to flow intermittently, presenting a level of disturbance not documented historically. The loss of aquatic prey during drought could negatively impact riparian and terrestrial species, including lizards. Because lizards play important roles in riparian food webs (e.g. predators, nutrient cycling), it is crucial to understand the cascading effects of stream drying on lizard communities. We hypothesized that perennial streams provide aquatic subsidies to terrestrial species, which reduces competition and opens niches for riparian lizards. We predicted that lizard communities near perennial water are more diverse than communities that do not have access to water and that individuals within a species will grow larger and faster with access to perennial water than those without. We surveyed three streams, each of which had paired 100-meter long perennial and ephemeral reaches that were similar in microhabitats but differed in water availability. At each of the six reaches, we carried out a 2-month mark-recapture study of three lizard species (*Sceloporus jarrovii, Sceloporus virgatus*, and *Urosaurus ornatus*) and measured the snout-vent length, tail length, and mass of each lizard we captured. We used emergence traps to quantify the availability of aquatic prey. We are still in the process of identifying these insect samples. Preliminary analysis suggests that lizards were scarce across ephemeral sites, but common at perennial sites. Analyses of mark-recapture data are ongoing, but I expect that the data will reflect my predictions of faster lizard growth along perennial streams. This study provides insights into food webs in riparian ecosystems and a greater understanding of how terrestrial and aquatic systems are linked via cross-system subsidies.

Doug Duncan* and Ross Timmons: How is historical range for fishes determined?

Determining the historical range for native fishes is important for understanding ecosystem functioning on a broad scale, determining how ecosystems and species have changed in the Anthropocene, and is vitally important when considering conservation actions. Comparing the current range of a species to its historical range is a major consideration when considering if conservation actions should be taken for the species and is especially important when considering if a species will be listed under the U.S. Endangered Species Act. The long-disbanded Desert Fishes Recovery Team, before it was unceremoniously terminated, and specifically team leader W. L. Minckley, discussed how historical range was viewed for at least the native fishes under the purview of the Recovery Team. I'm sure Dr. Minckley and other Recovery Team members applied that view of how historical range was determined to other native fishes. Basically, the view was that historical range should be considered extensively, and should not be limited to known collection localities, or even only streams with collections. The concept will be

discussed as to how it has been applied to the conservation of native fishes in Arizona, and how it has also created some conflicts with the conservation of native non-fish aquatic species.

Gorgonio Ruiz-Campos*, David Ceseña-Gallegos, Alejandro Varela-Romero and Sergio Sánchez-Gonzáles: Morphological characterization of the Sinaloa catfish (*Ictalurus* sp.) from Río Culiacán and its comparison with Yaqui catfish (*Ictalurus pricei*) from northern Sierra Madre Occidental, Mexico

In northern Sierra Madre Occidental (SMO) inhabits several native catfishes of the genus Ictalurus, of which the Yaqui catfish (*I. pricei*) is the only currently described. South of the Río Fuerte several populations of catfish referred to as Sinaloa catfish are known to occur. We performed a morphological comparison between the Sinaloa catfish of the Culiacán River (*Ictalurus sp.*) and Yaqui catfish, including other populations of the SMO. The analysis of discriminant function for 45 morphometric and meristic characters in 81 specimens examined yielded 12 characters to be significantly ($p<0.01$) different for these compared forms. The most discriminant characters were longest dorsal ray length, pectoral spine length, predorsal length, head length, and number of rays in anal and pelvic fins. The standardized coefficients for canonical variables 1 and 2 explained 90.4% of the total variation. The catfish of Río Culiacan (Humaya and Tamazula sub-basins) represents a distinct clade that is more associated to the catfish population of Río San Lorenzo, a relationship that has been genetically confirmed. The catfish of the Río Culiacán River represents a new biological entity of the SMO.

Catherine de Vlaming*, Kevin Bestgen: The Effectiveness of Light Traps for Capturing Razorback Sucker Larvae

Detection of endangered razorback sucker *Xyrauchen texanus* larvae by light traps is used to prompt flow releases to inundate Green River floodplains that are crucial to their survival. However, little is known about the efficacy of light traps to capture or retain larvae. We investigated effects of trap set time, release distance from trap, light presence, and turbidity on capture and retention rates of early life stages. Laboratory capture rates were a mean of 90% but decreased to 28% with increasing fish size. Retention exceeded 75% overall, but increased to 97% with increasing fish size. Relationships between set time and distance should be investigated, along with field testing. Light traps may be a useful gear to detect razorback sucker larvae in the wild and trigger flow releases from Flaming Gorge Dam.

Megan Bean*, Gary Garret, Robert Edwards: Desert Fishes Research and Management in Texas During 2017

Agency, university, and non-governmental organization conservation partners in Texas continue to undertake many management, restoration, and conservation actions to benefit aquatic species and habitats in the Chihuahuan Desert in the Rio Grande and Pecos watershed areas. Extensive monitoring for fish, invertebrates, and water quality began in the Balmorhea Springs complex to establish current baselines for aquatic species and habitats. Recent genetic analysis of the Pecos Gambusia population at San Solomon Springs revealed high levels of introgression with Largespring Gambusia. Monitoring and stocking efforts continued for the Rio Grande Silvery Minnow through the Big Bend

and Lower Canyons reach of the Rio Grande. Monitoring on the Devils River continues for Devils River Minnow, Conchos Pupfish, Texas Hornshell, and salamanders. Restoration efforts along the Rio Grande near Big Bend and along Rio Grande tributaries continues to restore riparian habitats. Conservation partners met to establish the Chihuahan Desert Native Fish Conservation Area priorities and are working to establish this prioritization framework for the rest of the Rio Grande watershed.

Parmenter, Steve, Sharon Keeney, Nick Buckmaster, Debra Hughson, Dawne Emery and Kevin Wilson. Native fish conservation and management in the Walker, Amargosa, Owens, Mojave, and Colorado basins in California

END OF POSTER SESSION

STUDENT MIXER 11/15/2017 06:00:00 PM
GROUP DINNER 11/15/2017 08:00:00 PM

THURSDAY, 17 NOVEMBER 2017

2017-11-17 08:30-8:45: Awards Presentation: Chuck Minckley

General Session III: Rio Sonoyta Symposium: Ed Kluender, Moderator

2017-11-17 08:45: Michael Bogan*, Nathan Dorff, Drew Eppehimer, Hamdhani, Kelsey Hollien and Earyn McGee: Aquatic invertebrate diversity and community composition at Quitobaquito, Organ Pipe Cactus National Monument

Quitobaquito spring and pond support the only natural populations of endangered Sonoyta pupfish and mud turtle in the United States. Despite long-term monitoring of pupfish and mud turtle populations, little is known about the food web that supports these imperiled species. To address this knowledge gap, we began a comprehensive inventory of aquatic invertebrates at Quitobaquito in April 2017. We will sample four times a year in the primary aquatic macrohabitat units at Quitobaquito, including the headspring, the pond and moat, and spring channel riffles, runs, and pools. To date, we have identified 116 aquatic invertebrate taxa from our collections, which nearly doubles the number of taxa known from previous surveys at Quitobaquito. In April 2017, moat and spring channel pool samples were the most diverse (mean taxon richness = 33 and 30, respectively). Riffle samples were the least diverse (mean taxon richness = 15), but were the primary habitat for several rare taxa (e.g. riffle beetles, aquatic moths). Several taxa greatly increased in abundance between April and June, including Helicopsyche caddisflies. The impact of these changing invertebrate abundances on pupfish and mud turtles or general food web dynamics remains to be determined. In October 2017, we will expand sampling efforts to include tissue collection from important food web components (e.g. algae, zooplankton, detritus) for use in stable isotope analyses. These

analyses should yield clues as to why Sonoyta pupfish and mud turtle populations fluctuate through time at Quitobaquito.

2017-11-17 09:00: Chuck Minckley*, Doug Duncan, Ross Timmons and Miguel Grageda: Fishes of the Sonoyta River, Past, Present, Future.

The Sonoyta River Basin lies adjacent to the U.S. Mexican border, south of Lukeville, Arizona. It is a disrupted segment of the Colorado River system. This talk presents information on native fish distributions, their status, past and continuing threats to those species. It also lists accomplished recovery actions, and presents/discusses options to maintain native fishes in the system.

2017-11-17 09:15: Miguel Angel Grageda* and Diego Garcia: Current population status of the Sonoyta pupfish (*Cyprinodon macularius*) and longfin dace (*Agosia chrysogaster*) in the Agua Dulce Ramsar site and reproduction refugees of Sonora, Mexico

We will describe the conservation status of Sonoyta pupfish (*Cyprinodon macularius*) and longfin dace (*Agosia chrysogaster*) in the Agua Dulce reach of the Rio Sonoyta in Sonora, Mexico. We will also describe the current distribution and status of these two threatened species in refuge habitats created at various locations in northwest Sonora. Ongoing threats to both species will be described and future management suggestions will be given to ensure the persistence of these endemic fish species in northwest Mexico.

2017-11-17 09:30: David Christianson, Michael Bogan, Tyler Coleman and Peter Holm: State-space models to estimated and understand trends in sparse populations from sparse data

Monitoring of Quitobaquito pupfish and Sonoyta mud turtle in Organ Pipe Cactus National Monument has been ongoing for several decades, but monitoring methods have changed throughout the years through turnover in personnel and equipment. Sampling noise inherent to survey methods, and subtle changes in implementation of survey methods have largely precluded any interpretation of trend from the current monitoring data and there is has not been any estimate of population growth rates in either of the two species. This has hampered not only the development and implementation of resource management plans in OPCNM but also the design of resource-question driven research into what factors may influence long-term persistence of these species. We present a summary of these survey methods and preliminary analysis into trend. We use an Exponential Growth State Space Models to examine existing counts considering the contributions of sampling error and process error contributing to variation in the counts. We also considered the potential for density dependent growth using the Ornstein-Uhlenbeck State Space Model (Dennis and Ponciano 2014). The estimate growth rates Quitobaquito pupfish are positive (3.0% annual growth) but significant uncertainty in these estimates precludes high confidence in these estimates. Increased precision in estimating population growth rates may be possible by allocating effort to repeat surveys every other year rather than single surveys each year. Linkages between year over year population growth and climatic factors are explored.

2017-11-17 9:45: Alejandro Varela-Romero*, Nohelia Pacheco-Hoyos, Román Rodríguez-Ramírez and Michael T. Bogan: Conservation Status and Genetic Management of the Sonoyta pupfish (*Cyprinodon eremus*) along the US-Mexico Border

The Sonoyta pupfish native range is restricted to the spring and pond of Quitobaquito (Organ Pipe National Monument, Arizona) and small reaches of the Sonoyta River (Sonora) along the international border. There is an immense concern for the conservation of this species due to threats posed by drought, groundwater pumping, introduced fishes, border traffic and dispersal barriers. Although the Sonoyta pupfish does not have conservation status in NOM-059-2010, it is of binational interest to preserve the species due to the extreme degree of desertification in the area. As a result of these concerns, a total of 5 refuges of the species have been created in Sonora in federal institutions such as the Reserve de la Biosfera El Pinacate y Gran de Desierto de Altar, state parks such as the Centro Ecologico de Sonora and the COBACH en Sonoyta, and NGOs as the CEDO in Puerto Peñasco. In Arizona there are four refuges of the species managed by federal, state and NGO agencies. However, comprehensive studies are lacking for all natural and refuge populations. In addition, refuge populations were established without regard to genetic variability and population structure. This lack of genetic consideration could hamper reintroduction efforts if they are used to repopulate natural habitats that are poorly adapted or genetically bottlenecked. Our project aims to respond to these information needs by determining the status of all natural and refuge populations of the Sonoyta pupfish in Arizona and Sonora through population sampling in natural habitats and assessments of refugee populations in captivity. In addition, it intends to use existing microsatellites to quantify the genetic structure of Sonoyta pupfish populations in natural, and to determine the genetic viability of refuge population, as well as the genetic representativeness of refuge populations to compare with published data of the natural populations. In addition, the morphometric characterization of the morphology of the refuge populations will be carried out to compare them with the wild populations, and to know if these refuge populations have a morphotype that corresponds to the one known for the species due to its maintenance in a different lentic habitat.

2017-11-17 10:00: Tyler Coleman: Management of Quitobaquito Pond, Organ Pipe Cactus National Monument, Arizona

The Quitobaquito aquatic system lies within Organ Pipe Cactus National Monument, Arizona. It is located on the international border with Mexico and is the nearest U.S. water source to the Rio Sonoyta, Sonora, MX. Quitobaquito has a rich and complex history which dates back several millennia. It has undergone a variety of human modifications over time and is currently home to two endangered species (Sonoyta pupfish and Sonoyta mud turtle) and one candidate species (*Quitobaquito tryonia*). The National Park Service manages the site for the conservation of protected species but a variety of other issues persist. Management is challenging due to multiple, often conflicting, values including cultural resources, historical use, tribal importance, designated wilderness, migratory birds, recreational use, biodiversity, and border impacts. Modern alterations have occurred throughout the 20th century. These modifications are necessary to maintain a constant water supply and protect the resource from degradation. Periodic actions include spring renovation, creation of a spring-fed channel, installation of a diaphragm wall, re-lining of the pond bottom, and removal of a senescent

cottonwood tree. In addition, constant upkeep is required to reduce encroaching vegetation to maintain water flow and to protect the cultural resources. All these actions, collectively, are required to assure that the site functions as its primary use as habitat for critically endangered species.

2017-11-17 10:15: Cat Crawford, Doug Duncan* and Hayley Dikeman: The endangered listing of the Sonoyta mud turtle

The Sonoyta mud turtle is an isolated endemic subspecies of the Sonora mud turtle in the Rio Sonoyta basin in southwestern Arizona and northwestern Sonora, an extremely arid environment. Historically, they were found in cienegas and streams that maintain water all year. Currently they are found in spring-fed and wastewater fed ponds and streams. Historically, there were likely four populations of the turtle-three in Sonora and one in Organ Pipe Cactus National Monument. These populations were likely hydrologically connected, at least periodically, allowing for immigration and emigration between the populations. Currently, one population in Mexico is extirpated due to loss of water, the other two in Mexico are extant but their range is greatly reduced due to water loss, and the U.S. population is extant. Two additional populations were found in 2002-one in wastewater ponds and one in Quitovac. These five populations occupy only about 8 to 20% of the historical range. The most significant historical and current stressor for the turtle is the loss of aquatic and riparian habitat due to groundwater pumping and long-term drought and climate change. All five populations are isolated from each other and each population is supported by very small amounts of aquatic habitat. A single stochastic event such as dredging or a year with little precipitation could eliminate an entire population. The high risk of extirpation of these populations is a result of low levels of resiliency, redundancy, and representation. Overall, these low levels of resiliency, redundancy, and representation result in the Sonoyta mud turtle having a high risk of extinction, and thus has been listed as endangered.

2017-11-17 10:30: Peter Holm* and Tyler Coleman: Population variation in the Sonoyta mud turtle at Quitobaquito

Quitobaquito is a rare perennial oasis in the Sonoran Desert that was historically connected to the Rio Sonoyta. Endemic to this system are the Sonoyta mud turtle, Quitobaquito or Sonoyta pupfish, and an undescribed form of long-fin dace. Intensive sampling of the Sonoyta mud turtle began at Quitobaquito in 1982 and over 2200 observations have been record until now. Population estimates (excluding young of the year) from 1984 to 2007 ranged from 39 to 134 (average 91.1, n=14) and from 2010 to 2016 ranged from 123 to 189 (average 155.8, N=7). Mud turtles at Quitobaquito are generally smaller than in the Rio Sonoyta. Two animals found dead were examined and found to be emaciated and growth rates following removal increased, suggesting that food may be limited. There are wide variation s in growth between individuals and between years. We don't fully understand the roles of climate, water quantity and quality, and species interactions. Due to declining spring flow and extremely low pond levels, 79 turtles removed in 2007-2009 and 24 repatriated in 2011. Sixteen of the repatriated turtles have been recaptured. Although Quitobaquito is a protected area, the future of its aquatic habitat cannot be guaranteed. Recovery efforts for the mud turtle should focus on

increasing the number of population units rather than increasing the capacity for Quitobaquito to support more individuals.

2017-11-17 10:45: Diego Garcia* and Miguel Angel Grageda: Individual movements and estimation of population size of the Sonoyta mud turtle (*Kinosternon sonoriense longifemorale*) in the Agua Dulce Ramsar site, Sonora, Mexico

The Sonoyta mud turtle (*Kinosternon sonoriense longifemorale*) is an endangered endemic species in the rio Sonoyta basin of southern Arizona and northern Mexico. In 2017, we began using radio tracking to monitor the survival and movement of individual Sonoyta mud turtles in the Agua Dulce reach of the Rio Sonoyta. We also have made estimates of the total population size in the Agua Dulce reach, which is the last relatively natural reach of the Rio Sonoyta that supports perennial pools. We will present preliminary findings of our tracking and population size studies and suggest future directions for monitoring and management of this endangered turtle.

2017-11-17 11:00: David Lytle*, David Merritt, Jonathan Tonkin, Julian Olden, Lindsay Reynolds, Patrick Deleenheer and Laura McMullen: Food webs without the food: population models for dynamic desert rivers

Community models fall along a spectrum of assumptions about species and their interactions. At one end, neutral biodiversity models do not require information about individual species' biology. At the other end, food web models define species largely in terms of biotic interactions that may or may not be understood. Interaction-neutral models present an alternative community modelling approach that falls in between. Species are highly-specified by their unique vital rates (fecundity, mortality, growth rate, etc.) under a range of environmental conditions, and these vital rates are incorporated into individual matrix population models or other suitable modelling structures. A dependency assumption (finite space for recruitment, upper limits on aggregate biomass, etc.) links individual matrices together, and cross-species sensitivity analysis can then be used to discover pairwise biotic interactions. This approach is especially suitable for desert rivers and streams, where population dynamics are strongly influenced by flood, droughts, and other hydrologic dynamics. We developed interaction-neutral models for riparian vegetation, aquatic invertebrates, and fish. Models recovered field-observed community patterns, suggesting that abiotic forcing by floods and droughts explains a significant amount of population dynamics. Cross-species sensitivity analysis identified species that had strong biotic effects on other community members (keystone species), as well as species with high bidirectional effects (mutual) or little influence on other species (passive). These results show promise for forecasting climate-induced population shifts in river ecosystems. In general, interaction-neutral models could be useful for modeling communities where among-species biotic interactions are poorly understood or highly dependent on environmental context.

2017-11-17 11:15: Kate S. Boersma*, Tyler B. Banks, Rachel M. Kincaid and Patrick D. Carroll: Temperature and dissolved oxygen determine submersion time in aquatic beetle *Peltodytes callosus* (Coleoptera: Haliplidae)

Global climate change affects aquatic habitats in a number of ways that pose challenges for aquatic insect populations. Increasing water temperature and corresponding decreases in dissolved oxygen can impact respiratory behaviors, even in air-breathing aquatic taxa. Crawling water beetles (Coleptera: Haliplidae) exhibit a combined respiratory strategy that employs a subelytral air store that is periodically replenished at the water surface. The frequency at which beetles must surface to replenish the bubble is determined both by oxygen consumption and by the capacity of the air store to uptake oxygen from the surrounding water via diffusion. However, little is known of how changes in water temperature and dissolved oxygen will affect submersion time. We investigated this question in *Peltodytes callosus*, a species of crawling water beetle that is widely distributed across the American West. We manipulated temperature and dissolved oxygen to mimic changes associated with drought and recorded the time between surfacing events. We found that beetles stayed submerged for shorter durations in response to both increasing water temperature and decreasing dissolved oxygen. Our results suggest that beetles may be able to modify their surfacing behavior to respond to climate-induced changes in water quality.

2017-11-17 11:30: Local Student Presentation(s)

2017-11-17 12:00-14:00: LUNCH

<u>2017-11-17 14:00-15:30 General Session IV: Eric Kortenhoeven Moderator</u>

2017-11-17 14:00: Michael Schwemm*, Kevin Wilson, Jeffrey Goldstein, Ambre Chaudoin, John Wullschleger, Corey Lee, Olin Feuerbacher, Javier Linares and Brandon Senger: Current status and future management directions of the Devils Hole pupfish

The Devils Hole pupfish (*Cyprinodon diabolis*) of southern Nevada occurs in likely the smallest habitat of a vertebrate taxon, and as such exhibits a precarious and complex history of conservation management. This report updates the Desert Fishes Council on the current status and future management of the species. The most recent census at Devils Hole (a semi-annual estimate by direct count) was 115 fish on September 16 and 17, 2017. This count was lower than fall counts of immediately prior years 2016 or 2015 (144 and 131 fish, respectively). Nonetheless, because life-history attributes, seasonality and stochastic impacts on habitat strongly influence short-term demography, 2017 results are not extraordinary in this system over the past three years. Instead, the relative stability at a population size far below historic levels represents an ongoing management concern. The sole refuge population outside of Devils Hole at the Ash Meadows Fish Conservation Facility houses approximately 60 additional animals in the refuge tank, and 25 animals collected as eggs from Devils Hole over the preceding fall (2016) and spring (2017). Animals housed in the refuge tank consists of all life-stages, indicating natural recruitment. Similar to the Devils Hole population, the level of recruitment and population size in the refuge tank is lower than expected given habitat size and

productivity. Potential explanations for observed population sizes and ongoing research objectives will be discussed.

2017-11-17 14:15: Stewart Reid* and Damon Goodman: Range fluctuations in Pacific Lamprey along the arid Pacific Coast of southern California

Long-term monitoring, surveys and incidental observations of Pacific Lamprey, *Entosphenus tridentatus*, established a declining trend in all populations south of Big Sur, with the apparent disappearance of Pacific Lamprey from all southern streams by 2016. Factors for the disappearance of lampreys may include long-term drought, urbanization, water management, oceanic conditions and passage barriers. A passage improvement project in San Luis Obispo Creek mitigated the barrier in 2013. No lampreys were found in monitoring surveys from 2011-2016. However, in 2017 Pacific Lamprey were once again spawning in the middle of town. Additional scattered observations of adult lampreys occurred in other southern California drainages in 2017. These observations provide insight into natural range fluctuations and the possible changes that may be seen with environmental shifts over time.

2017-11-17 14:30: Taylor Ulrich* and Scott Bonar: Techniques for Using Simple, Inexpensive High-Definition Video Technology to Film Cryptic Underwater Species

Many aquatic organisms are cryptic and infrequently seen by the public, potentially causing apathy of the public toward these fishes and their ecosystems, which hinders their conservation. Fortunately, advanced technological means to acquaint the public with these and other aquatic species is becoming increasingly common. We developed methods to collect and process high definition underwater video footage that are specifically tailored to inexperienced users. Here we show the quality of high-definition underwater footage possible with current low-cost, advanced technology, and how field biologists, managers, professors, and students can use such equipment to great effect with an array of lenses and inexpensive camera mounts. We found low cost technology can provide spectacular visual results and has served as an effective tool to acquaint the public with the rare desert fishes found in our region.

2017-11-17 14:45: Paul Badame and Krissy Wilson*: Upper Colorado Basin Area Report

Activities continue in an effort to improve the status of many native fishes of the Upper Colorado River Basin. These activities are guided principally by four programs: the Upper Colorado River Endangered Fish Recovery Program, the San Juan River Basin Recovery Implementation Program, the Range-wide Conservation Agreement for the Colorado River Cutthroat Trout, Oncorhynchus clarkii pleuriticus, and the Range-wide Conservation Agreement and Strategy for the "Three Species" (roundtail chub, *Gila robusta*, bluehead sucker, *Catostomus discobolus*, and flannelmouth sucker, *C. latipinnis*). The two recovery programs, which collectively work towards the recovery of Colorado pikeminnow, *Ptychocheilus lucius*, razorback sucker, *Xyrauchen texanus*, bonytail, *G. elegans*, and humpback chub, *G. cypha*, use the protection of in-stream flow, habitat restoration, nonnative fish control, propagation, life history monitoring, and information and education to bring benefits to the four "big river fishes." A species status assessment for razorback suckers is near completion and an SSA for humpback chub has gone through peer review. Tasks to assist the species under Conservation Agreements

included multiple remote sensing projects in tributaries throughout the basin; tamarisk control and watershed habitat restoration efforts are occurring; distribution and density monitoring throughout their ranges; and renovation of trout streams and reintroduction of the Colorado River cutthroat trout continues in Colorado, Utah, and Wyoming.

2017-11-17 15:00: Chuck Minckley* and Alejandro Varela: A Summary of Fish Collections from Cajon Bonito, Sonora, Mexico past and present

Cajon Bonito is a northern tributary of the Yaqui River of Sonora, flowing just south of the International Border with the United States. This system still supports most of the Yaqui fishes, including a viable population of what is thought to be the Yaqui catfish, *Ictalurus pricei*. Information on changes in species composition between historic and more recent collections is presented, as well as future plans for the catfish, presuming they are Yaqui catfish.

2017-11-17 15:15: Dean A. Hendrickson: A tale of two catfishes: Yaqui and Chihuahua

While the Yaqui Catfish, *Ictalurus pricei*, has a long history of listing and conservation interest, the still undescribed Chihuahua Catfish remains largely unknown to many working on fishes and aquatic resource management in its range. Like Yaqui Catfish, it is similar to the ubiquitous Channel Catfish, and until awareness is increased, it will remain understudied and with little protection. Also like Yaqui Catfish, hybridization with closely related species greatly confounds research and recovery efforts. Known only from an unfinished manuscript describing it, and many specimens identified cryptically (since it remains undescribed) as this species in a few collections' databases, and occasional mentions in the literature, its historic distribution includes most of the Rio Grande/Bravo watershed (including all 3 major sub-basins (Conchos, Pecos, Grande/Bravo) and a relatively small area of the Gila River basin. It appears to be now very rare, and it appears to hybridize with both I. punctatus and I. lupus. Cytochrome b sequences obtained from one recently collected specimen from each the Gila basin and the Conchos basin in Chihuahua (at or very near the manuscript's type locality), indicate two divergent haplotypes. The manuscript's authors did not recognize that divergence, and considered it introduced in the Gila, so did not include specimens from there in their morphological analysis, but thought the form there to be introduced from the Río Grande/Pecos. We'll here present images of specimens, and summarize the diagnostic characters known from the manuscript, though hybridization clearly confounds morphological diagnosis. All those collecting catfishes anywhere in the species' broad range are asked to be aware of its existence, and to deposit large series of vouchers and tissues in museum collections for future efforts to better diagnose these rare fishes and conserve them.

2017-11-17 16:00: Informal Yaqui discussion – meeting place to be determined

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2017-11-17 17:30-19:00 **Business Meeting**
2017-11-17 20:00-22:00 **Banquet**

SATURDAY, 18 NOVEMBER 2017
2017-11-18 8:00-17:00

PINACATE BIOSPHERE RESERVE

CIENEGA DE SANTA CLARA/EL DOCTOR WETLANDS