La Plata – Friday, February 10th 1-3:00 PM
Fisheries Student Paper Competition

Razorback and Flannelmouth Sucker hybrids; hatch rates, larval survival and geometric morphometrics

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Oral Presentation

Historically in the Colorado River, hybridization between Razorback Sucker and Flannelmouth Sucker rarely occurred because of separation of spawning location and timing. As a result of modification of the river by dams, we are seeing an increase in hybridization between Razorback and Flannelmouth suckers. To enhance conservation and management of the endangered Razorback Sucker, the Arizona Game and Fish Department, in collaboration with Grand Canyon Research and Monitoring Center-USGS, and Northern Arizona University are conducting studies to evaluate sucker hybrid viability and develop field identification tools for hybrid suckers. Gametes from both species were stripped and mixed to make four treatments: 1) female Razorback x male Flannelmouth, 2) female Flannelmouth x male Razorback, 3) Flannelmouth Sucker, and 4) Razorback Sucker. Hatch rates and larval survival were quantified for each treatment. We had little success with flannelmouth suckers producing viable eggs for the experiment, thus results presented are for treatments one and four only. In general hatch rates were very low (~5%). Preliminary results show no statistical difference in hatch rates and larval survival among the two treatments. Geometric morphometric analyses were conducted to examine shape differences among treatment combinations. The results of the geometric morphometric analyses may have strong implications for identifying hybrids in the field.

Assessing Modified Prepositioned Areal Electrofishing Devices (PAEDs) for Surveying Fish Habitat Use in Desert Streams

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Oral Presentation

Precise methods are often needed to characterize habitat use by fishes, especially for litigation and detailed habitat modelling. Pre-positioned areal electrofishing devices (PAEDs) have been developed to survey stream fishes and develop habitat suitability criteria. PAEDs, which consist of a shore-based generator and a submerged electrical grid, are less intrusive than other electrofishing methods and result in little to no fright bias, i.e., flight response, in fishes from the electrical stimuli. Standard practice allots

eleven minutes post-implementation of the devices to allow fishes to recolonize the area. Thus, these low-cost apparatuses can sample distinct areas of stream reaches to assess the microhabitat of fishes. Challenges to using PAEDs include speed of deployment and difficulty of their transport to remote areas. Here we compare various forms of PAEDs to establish a technique for effective fish sampling at remote sites that considers fright bias, fish mortality, and the size of the electrical field. A digital multimeter and underwater videography were used to assess the electrical fields of various PAED designs and the fright bias induced by different techniques. We found that modified PAEDs connected directly to a boat-mounted AC power source were sufficient for sampling desert fishes without inducing mortality or fright bias. Also, neither using two devices simultaneously nor using a 30-m extension cord affected voltage near the electrodes. This study demonstrated effective ways that PAEDs can be used to sample stream fishes in remote areas when collecting microhabitat parameters.

Why Catch-Per-Unit-Effort is Insufficient as an Index of Abundance for the White Sands Pupfish (Cyprinodon tularosa)

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Oral Presentation

An important goal amongst researchers and managers is to accurately quantify population parameters to detect shifts in survival and abundance. Some organisms represent a monitoring challenge when they are locally abundant, short-lived, and alter their reproductive strategy as environmental conditions vary. Here, we present evidence that the use of minnow traps combined with a commonly calculated index of abundance for pupfish (i.e., catch-per-unit-effort CPUE) can be affected by basic methodological choices such as trap soak time (i.e., effort) as well as the timing and location of trap placement. We investigated movement into and out of torpedo-shaped (Gee) traps by White Sands pupfish (Cyprinodon tularosa) and the effect movement would have on CPUE. White Sands pupfish exited traps at frequencies that were nearly equivalent to the rate of entering, suggesting total catch and thereby CPUE, are strongly influenced by factors that determine the probability of an animal exiting the trap. In addition, CPUE was weakly correlated with a more robust estimate of abundance (Lincoln-Peterson estimator) suggesting CPUE is not a good index for abundance especially when trap soak times are variable. We recommend the use of capture-recapture protocols to account for differences in capture probabilities due to factors unrelated to abundance such as habitat and capture effort.

Videography presentations to educate the public about Arizona trouts

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Oral Presentation

Gila, Oncorhynchus gilae, and Apache, Oncorhynchus apache, trout are critically threatened species that can be found in various streams of the Southwest. The general public is often unaware that these species exist due to many factors including a dissociation of fish and desert environments and limited availability of high quality footage. Surface and underwater videography was utilized to create an educational video on Gila and Apache trout to be displayed at a Coronado National Forest visitor center and other locations. We captured high definition quality footage with low cost equipment with the intention of enabling natural resource managers to produce similar conservation videos easily in the future. To evaluate what aspects make a conservation video most effective, the footage was shown in a public space. By analyzing which images people viewed the most, we were able to understand how we might produce more engaging presentations. Macro images, contrasting colors, texture, and movement held audience attention the longest. These results allowed us to draw conclusions about which factors and characteristics of the film contributed to optimal audience engagement. Well- designed videos will better acquaint people with species that are not commonly seen, thus aiding in their conservation.

Use of High-Definition Video Technology to Acquaint the Public with Cryptic Desert Fishes of the Southern Nevada/Death Valley Region

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Oral Presentation

Desert fishes are cryptic, and infrequently seen by the public. Apathy of the public toward these fishes and their ecosystems hinders their conservation. Fortunately, advanced technological means to acquaint the public with these species is becoming increasingly common. We are creating low-cost educational videography presentations featuring the unique and often rare desert fishes of Nevada and Death Valley. Here we provide examples of high-definition underwater and aerial footage possible with current low-cost, advanced technology. Techniques used to collect this footage are specifically tailored to be used by field biologists when creating educational presentations. Furthermore, we outline marketing and educational research methods we are investigating to maximize presentation effectiveness. Low cost technology can provide spectacular visual results and could potentially serve as an effective tool to acquaint the public with rare desert fishes.

Effects of Wildfire on Brown Trout (Salmo trutta) Foraging Ecology

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Oral Presentation

Wildfire is a natural disturbance with many effects on the surrounding landscape. The Las Conchas wildfire in June of 2011 burned one third of the Valles Caldera National Preserve (VCNP), New Mexico. Over 90% of the Brown and Rainbow Trout populations and the diversity and densities of the benthic communities were reduced. We aim to understand how reduced fish densities and insect communities affect the foraging ecology of the trout populations. Based on optimal foraging theory, we predicted high-density Brown Trout populations from unburned areas would be less selective foragers than trout from low-density burned areas. We collected diet-availability data of Brown Trout via gastric-lavage for diet electivity analysis. Samples were collected from a burned, low-density stream, and an unburned, high-density stream. We observed trout from the high density site selected 4 out of 6 diet items in higher proportion than available, while only 2 of 6 diet items were strongly selected by trout in the low- density stream, supporting our hypothesis of more generalist foragers in high-density streams. A significantly higher number of prey on average were consumed by trout in the high density stream (50.6 number of prey/fish ± standard error 10.8) than the low-density stream (16.2 number of prey/fish ± 3.4). However, this may be due to the significantly higher number of benthic prey also available in the high- density stream (22,222 insects/m2 ± 7,535) than the low-density stream (2,085 insects/m2 ± 457). Our results suggest wildfires may impact more than just density, but may also indirectly affect the foraging ecology of aquatic populations.

San Juan – Friday, February 10th 1:40-3:00 PM
Sportfish Syposium

Algae production in fish hatcheries: We're doing it on purpose.

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Leonard Rice, New Mexico Department of Game and Fish, Glenwood Fish Hatchery, & Catwalk Rd, Glenwood, New Mexico, 88039.

Oral Presentation

Aquaculture facilities are required to maintain a federally regulated discharge permit under the National Pollutant Discharge Elimination System (NPDES). Limits are placed on specific pollutants such as total suspended solids, settleable solids, and nutrients. Algal Turf Scrubbers (ATS) are emerging as a way to help reduce nutrient levels in effluent, especially in situations of tightening restrictions on discharge waters. ATS systems operate by sequestering nutrients in managed algae growth. Periodic harvest is required for continued nutrient sequestration. Glenwood Hatchery is experimenting with an ATS pilot system to determine if a reduction in total nitrogen and total phosphorous is possible with a given water flow. Water flow/size ratio, harvest interval, and lighting intensity will be compared to outflow reductions in total phosphorus and total nitrogen, and to total biomass production. After sufficient data is collected, decisions can be made about the cost, effectiveness, and maintenance of scaling up to a full sized system capable of affecting a specific hatchery's cleaning effluent.

Angler Recruitment, Retention and Reactivation in an Age of Social Media. Can Social Media inspire and Teach People How to Enjoy the Outdoors…Some Thoughts From an Old Guy.

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Oral Presentation

Recruitment, retention and reactivation remain the keys to maintaining the rich traditions of hunting and fishing in this country. Historically, these activities were handed down each generation from parents and relatives to offspring being raised in rural communities. Stories legends and lessons of each generation were passed on through "fish tales". The country is becoming increasingly urbanized, and currently, 60-70 percent of the population resides on about 3.5 percent of the land. The tradition of fishing is being lost as people move away from the land that provides these opportunities. Can social media be utilized to help people rediscover the joys and skills associated with fishing? The Outdoor Recreation Adoption Model (ORAM) has recently become well accepted by hunting, shooting and angling groups as the best model to use when discussing the past and future of outdoor recreation. We will discuss the application of social media to the parameters in ORAM to benefit recruitment, retention and reactivation of anglers and to inspire traditional outdoor activities.

Walleye Strontium Isotope Analysis: New Mexico's Tail

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Oral Presentation

A preliminary study to determine the average strontium isotope ratio (87Sr:86Sr) of Walleye populations and Rock Lake Hatchery in New Mexico. We investigated the potential use of the strontium isotope ratios for future research looking at stocked versus natural reproduction and Walleye movement within watersheds. We found that all reservoirs containing Walleye differed from the Rock Lake Hatchery signature. Of the 9 reservoir populations tested only Elephant Butte Lake and Caballo Lake were indistinguishable from each other. Study results indicate strontium isotopes ratios can be used in New Mexico to investigate natal walleye origins and may prove a useful management tool to prescribe stocking rates and track movement.

Picking the Low Hanging Fruit, the Dogtown Lake Fish Habitat Project.

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Oral Presentation

In 2014 the Flagstaff Region of the Arizona Game & Fish Department Teamed with the Williams District of the Kaibab National Forest, Northern Arizona Flycasters Club and the Grand Canyon Chapter of Trout Unlimited to start placing fish habitat in Dogtown Lake. This talk will outline how the Department and

its partners took advantage of an approved Forest Service tree thinning project to put over an acre of fish habitat, over a 3 year period, into the 70 year old reservoir using a little bit of cement, wire and some labor. Topics covered will include lessons learned, along with some anecdotal changes that have occurred with the fishery since the project began.

La Plata – Friday, February 10th 3:20 – 5:00 PM

The contribution of the Gila River Basin Native Fishes Recovery Program (GRBNFCP/CAP) to the recovery of native aquatic species

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Oral Presentation

The Central Arizona Project, in 1994, was found to jeopardize the Gila Topminnow, Spikedace, Loach Minnow, and Razorback Sucker under Section 7 of the Endangered Species Act. As part of the reasonable and prudent alternatives to remove jeopardy, the Bureau of Reclamation funded two programs: the recovery of native species, and management against non-native species; funding began in 1997. The program intended to conserve and recover the four jeopardy species in-lieu of threat removal. In 2008, Gila chub and Chiricahua leopard frog were added to the list, and other species that will be listed will likely be added.

The GRBNFCP has greatly contributed to recovery of the four jeopardy species, and to other Gila River Basin listed, proposed, and unlisted, native aquatic fish. We will enumerate how tasks identified in final and draft species recovery plans have been implemented, or partially implemented, under GRBNFCP funding. We will also discuss how the GRBNFCP has enhanced the conservation status of native Gila River basin native aquatic species.

Is Gila Topminnow Still In Danger of Extinction?

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Oral Presentation

Gila topminnow, Poeciliopsis occidentalis, status has improved since the recovery plan was finalized in 1984. At that time, Gila topminnow was present in 15 localities: 9 natural and 6 repatriated populations. Gila topminnow were stocked into over a hundred sites in the 1980s, and by 1989, it was thought the species could be reclassified as threatened. However, drought and nonnative species caused most of the populations established in the 1980's to disappear. By 1998, when a revised recovery plan was drafted, there were 44 populations: 14 natural; 18 repatriated into wild locations, and 12 captive. Repatriations have continued and now are done under a general strategy of resilience, redundancy, and representation. To achieve resilience, minimum population size is 500 adults. To achieve redundancy, each of the five genetic management units is replicated, and to achieve representation, the replicated populations are dispersed throughout historic range. Currently there are 58 populations that have persisted for at least 3 years and 16 newly stocked. Each genetic management unit has been replicated multiple times: 16 Monkey/Cottonwood Springs, 16 Bylas Springs, 10 Cienega Creek, 9 Lower Santa Cruz, and 7 Sharp

Spring. Further, the 58 populations are widely spread across the Gila River basin: 9 in the Gila River Basin above Coolidge Dam, 17 in the Salt River Drainage, 5 in the Agua Fria drainage, 6 in the San Pedro River drainage, 21 in the Santa Cruz River drainage. Therefore, the risk of extinction is extremely low. Reclassifying the species as threatened is warranted.

What's new at Fossil Creek? A summary of recent Arizona Game and Fish Department monitoring efforts on Fossil Creek, AZ (2009-2015).

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Oral Presentation

Fossil Creek is an important native fishery in Arizona. A piscicide treatment and construction of a permanent fish barrier in 2004 eliminated Green Sunfish (Lepomis cyanellus) and Smallmouth Bass (Micropterus dolomieu) from an approximately 13 mile section of Fossil Creek. A native sport fishery was developed in 2009 to provide the anglers of Arizona with a unique fishing opportunity to fish for native chub. In response to the new fishery AGFD began surveys in 2009 using baited hoop nets to monitor the chub population in the sport fishing reach (from high fall to the confluence with Sally May Wash). In 2010/2011 heavy spring runoff caused the permanent barrier to fail allowing Smallmouth Bass to infiltrate the native fishery. A temporary barrier was constructed to contain the bass to a 3 mile section of the stream from Sally May Wash downstream to the barrier. In 2012 A piscicide treatment was conducted to eradicate the Smallmouth Bass. Survey efforts were expanded in 2012 to include the newly treated section of stream. Hoop netting was conducted to monitor the re-colonization of native fish to the treated section of stream and snorkeling to monitor for nonnative fish. This talk summarizes AGFD monitoring efforts of Fossil Creek from 2009-2015.

Reduction in spring flow threatens Rio Grande Silvery Minnow: trends in abundance during river intermittency

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Oral Presentation

Habitat fragmentation and changes in flow regime can structure fish assemblages, resulting in extirpations or invasions. A guild of freshwater stream fishes that spawn semi-buoyant, nonadhesive eggs directly in the water column are particularly susceptible to extirpation in fragmented streams. The pelagic broadcast-spawning Rio Grande Silvery Minnow Hybognathus amarus was listed as endangered in 1994 and has been intensely managed since. I used mean May flows and the number of times the channel dried within a year to predict numbers of Rio Grande Silvery Minnow captured in isolated pools in the Middle Rio Grande, New Mexico. Adult Rio Grande Silvery Minnow numbers increased as previous year's mean May discharge increased, and generally decreased with each subsequent drying event. Similarly, numbers of young-of-year Rio Grande Silvery Minnow increased with increasing mean May discharge in the current year. However, young-of-year minnow were either very abundant or nearly absent in isolated pools, depending on mean May discharge. Overall trends show a strong decrease in total yearly numbers of adult and young-of-year Rio Grande Silvery Minnow collected in isolated pools from 2009 to 2014,

coupled with an increase in the proportion of hatchery-reared adults. Overall numbers fell from >1,000/km in 2009 to <15/km in 2014. Hatchery-reared fish increased from 0% in 2009 collections to 90% in 2014 collections. Managers should focus recovery efforts on providing spring flows that improve recruitment, and avoiding consecutive years of low spring flow because any population recovery will likely be negated by three consecutive years of recruitment failure. A self-sustaining population of Rio Grande Silvery Minnow is unlikely without management options that mitigate the effects of multiyear droughts.

Improving Wildlife Management by Promoting Multidisciplinary Science and Collaboration

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Oral Presentation

The Gila River Basin Native Fishes Conservation Program (GRBNFCP) is dedicated to recovering native fishes within the Gila River Basin of Arizona and New Mexico. Between 2007 and 2016, Arizona Game and Fish Department (AGFD) GRBNFCP-funded staff conducted various native fish recovery projects, including habitat assessments, nonnative fish removals, native fish introductions, and population monitoring within Arizona. During these activities, observations of non-target species, such as the Sonora Mud Turtle (Kinosternon sonoriense sonoriense), were routinely recorded. In 2012, the AGFD listed the Sonora Mud Turtle as a Tier 1B Species of Greatest Conservation Need as this species ranked as vulnerable in demographic and fragmentation status. Due to the extensive number of Sonora Mud Turtle observations documented, we compared this data to the current species distribution. We discovered that very little observational data is readily available for this common species within Arizona's Heritage Data Management System (HDMS), which is used to determine species status and distribution, and to evaluate potential development, economic growth, and environmental projects within Arizona. We found that by adding GRBNFCP observations to the HDMS database, we increased the number of Sonora Mud Turtle observations by 9.1%. Observations of common or non-target species are often not recorded or reported upon during surveys; however, this information is valuable in order to keep common species common. We strongly encourage biologists from all disciplines to work collaboratively and record data on all taxa encountered during surveys and monitoring efforts.

San Juan – Friday, February 10th 3:20 – 5:20 PM
Sportfish Symposium

Angler success and satisfaction: effects of a guide on fishing experience

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Oral Presentation

The Lees Ferry fishery located on the Colorado River within Glen Canyon National Recreation Area, Arizona is a very popular Blue Ribbon Rainbow Trout fishery that supports a thriving guiding industry. The Arizona Game & Fish Department has been conducting angler surveys at Lees Ferry since 1977. Angler surveys are an effective management tool used to determine fishery usage and catch rates within a sport fishery. Currently annual access point (boat ramp) angler surveys are conducted six days a month, two weekdays, and four weekend days. We analyzed boat angler surveys from 2011-2016 to investigate factors that affect angler success and satisfaction particularly in relation to utilizing a guide. Angler success was based on the number of fish caught, (catch per unit effort (CPUE)), while angler satisfaction was based on individual anglers rating their fishing experience on a scale of one to five. Anglers utilizing guides had a significantly higher average catch per unit effort (CPUE) of 1.94 fish/hour compared to private anglers CPUE of 1.28 fish/hour. On a scale of one to five, guided anglers rated their satisfaction significantly higher (4.64) than private anglers (4.12). In the model investigating CPUE, having a guide explained most of the variation, followed by year, and then gear type (fly, spinning, or both). CPUE explained most of the variation in angler satisfaction followed by, using a guide, and year. Our findings suggest that hiring a guide at Lees Ferry leads to higher CPUE and a more satisfactory experience.

Examining angling and boating use on a large reservoir using time-lapse trail cameras

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Oral Presentation

Each fishery is comprised of three primary manageable components: habitat, biota, and human users. In order to manage fisheries effectively, accurate data on angler use are needed to drive sound management recommendations. Angler use data are most commonly gathered using in-person creel surveys; a technique that gathers accurate angler data but can be expensive and time-consuming. This is particularly true for large reservoirs where angling use is often both spatially and temporally distributed. Therefore, the objective of this project was to evaluate using digital time-lapse trail cameras to gather angling and boating data on large reservoir in Arizona. Trail cameras were installed at boat ramps from December 2015 to May 2016 on Lake Pleasant (4,873 ha surface area), a popular reservoir located near Phoenix. Each camera was programmed to record a picture every 5 seconds in daylight hours. After collection, time-lapse data were analyzed independently by two reviewers to assess angling and boating use. Reviewers counted number of both fishing and recreational boats, and tracked individual fishing boats to gauge trip length. While time-lapse analysis can also be time-consuming, we found that time-lapse trail cameras can gather accurate angling and boating data and thus provide an excellent alternative to in-person surveys under certain circumstances.

Use of cold branding in marking Channel Catfish.

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Oral Presentation

Cold branding (freeze branding) has been used for many years in both the livestock and fisheries industries. The process uses branding irons cooled with liquid nitrogen to freeze the epidermal layer leaving a permanent "scar". New Mexico Game and Fish had a need to distinctly mark multiple Channel Catfish (Ictalurus punctatus) cohorts for a stocking evaluation. Freeze branding techniques from Illinois (walleye) were modified and tested on both sub-adult and fingerling Channel Catfish on a small scale. Short term evaluation showed that brands on the ventral surface were the most recognizable. From this information a marking process was developed including the use of Aquis20 (synthetic clove oil) as a sedative under INAD permitting. A long-term mark retention study is ongoing with double marked (branded and fin clipped) Channel Catfish being stocked into multiple waters for future recapture and evaluation of long term mark retention.

Learning More about Arizona's Own River Monster: a Proposed Study to Age Flathead Catfish in the Lower Colorado River.

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Oral Presentation

Flathead Catfish (Pylodictis olivaris) are the largest fish in Arizona and are a highly sought sportfish species in the Colorado River. The region IV aquatic wildlife program has been performing species-specific surveys for Flathead Catfish on the Imperial Division of the Colorado River annually since 1997. From these surveys a strong dataset on the relative abundance, size, and condition of Flathead Catfish has been developed, but little information exists regarding age structure. Only one past study was successful in determining growth rates and age structure of this population. Young and Marsh (1990) determined ages of the Flathead Catfish collected in the Lower Colorado River to range from zero to nine years old. Additionally the authors collected Flathead Catfish ranging from 58 to 1,010 mm in length, but were unable to collect many fish greater than 700 mm. Overall more robust age information is needed to understand the population dynamics (e.g., recruitment, growth, and mortality) of this popular fishery. Therefore, beginning in the spring of 2017, the region IV aquatic wildlife program will begin a pilot study with the objective of strengthening age data of Flathead Catfish less than 700 mm in total length and add additional age data on large Flathead Catfish with a total length greater than 700 mm.

Habitat use by juvenile fishes, macroinvertebrates, and zooplankton among three species of emergent macrophytes

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Oral Presentation

Aquatic vegetation serves an important ecological role. Previous research on the interactions of macrophytes and aquatic organisms has focused on submersed macrophytes, primarily because of their structural complexity and associated ecological impacts. However, the role of emergent vegetation is far less understood and often overlooked because they lack structural complexity. We evaluated three common emergent macrophytes and an open water habitat, and determined use among multiple aquatic taxa. Pelican Lake, Nebraska, served as our study system because it is dominated by three emergent macrophytes: common cattail (Typha latifolia), softstem bulrush (Schoenoplectus tabernaemontani) and common reed (Phragmites australis). Juvenile fishes (yellow perch [Perca flavescens] and bluegill

[Lepomis macrochirus]), zooplankton and benthic macroinvertebrates were sampled concurrently in each habitat patch over three months (August, September, and October). We identified few clear or consistent overall patterns in habitat use among emergent vegetation species across these aquatic taxa. However bluegill and some zooplankton taxa were more abundant in emergent vegetation compared to open water habitats. Conversely, habitat use for some macroinvertebrate taxa differed among emergent vegetation species. Our results suggest that managers could select from a variety of emergent vegetation species to address management objectives, while also balancing ecological and social tradeoffs.

An Overview of Fish Habitat Improvement Projects by New Mexico Department of Game and Fish and Fish Population Response

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Oral Presentation

In New Mexico 79% of anglers spend some portion of their time fishing in streams or rivers every year. Trout habitat in many of these streams and rivers has been degraded by anthropogenic alterations and climate impacts. Since 2012, the New Mexico Department of Game and Fish has completed several fish habitat improvement projects to mitigate these impacts and improve angling opportunity. These projects focus on decreasing width-to-depth ratios, increasing native riparian vegetation, improving habitat complexity, decreasing fine sediment, increasing residual pool depths, stabilizing stream banks, and increasing the frequency of pools and woody debris. Habitat and fish population surveys were conducted in several reaches to monitor responses to habitat manipulations. Mean qualitative habitat improvements include width-to-depth ratio decrease of 37.1%, fine sediment decrease of 4.7%, pool habitat increase of 13.7%, bank instability decrease of 5.5%, and large woody debris increase of 5.7%. Long term fish population monitoring is ongoing, and preliminary data suggest positive fish population response with increases in trout densities ranging from 8 to 94% post project completion.

La Plata – Friday, February 11th 8:20-10:00 AM

Reproductive Potential of Rio Grande Silvery Minnow (Hybognathus amarus)

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Oral Presentation

The Rio Grande silvery minnow (RGSM; Hybognathus amarus) was listed as federally endangered in 1994 and currently inhabits less than 7% of its historic range. Captive propagation and augmentation of wild stocks has occurred since 2001. The majority of wild-caught adults are age 1+ with a smaller portion represented by 2+. However, captive propagated stocks maintain year classes up to 4+. Augmentation of the wild population will sometimes use these older year classes. Information is needed to determine the fecundity of the various age classes of hatchery-reared RGSM to better assess the contribution of individual year classes when augmenting the wild population. Our objectives were to determine total

fecundity of 1, 2, 3 and 4-year-old adult RGSM, compare spawned egg counts (actual) to volumetric estimates. Spawning trials were conducted on four age classes (year hatched/age class): 2009/4, 2010/3, 2011/2, 2012/1. Eggs were collected from the first spawning bout of paired mating (n=10) from each age class and counted by hand using photo imagery. Spawned fecundity increased as age class increased from 2,362 eggs (± standard error 302.44) in age 1 fish to 10,495 eggs (± 784.09) in age 4 fish. Residual fecundity (total number of vitellegenic ova) increased as age class increased from 988 ova (± 78.66) in age 1 fish to 4,934 ova (± 598.06) in age 4 fish. Thus, total fecundity (residual + spawned) increased among age classes from 3,017 (± 214.09) in age 1 fish to 15,522 (± 284.16) in age 4 fish. Examination of residual ova revealed that RGSM would have spawned multiple times throughout the season. However, the first spawn represented the largest egg output. Volumetric estimates were very close to actual counts with a difference of 11-12.3%.

Reproductive Strategies of White Sands Pupfish (Cyprinodon tularosa) Inhabiting Stable and Variable Habitats

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Oral Presentation

A fundamental theory in the evolution of mating systems is the interplay between mate choice and reproductive signaling. Reproductive signals such as bright coloration, body size, and agonistic behavior influence mate selection by females; however, these signals may not be an accurate means of judging the relative fitness of an individual. When such signals fail, animals may adopt a bet-hedging strategy where reproductive investment is based on the reliability of a given cue to compensate for variation in reproductive success across generations. The White Sands pupfish (Cyprinodon tularosa) was used as a model organism to test the hypothesis that mate choice strategies are influenced by environmental stability. Wild fish were collected from two genetically distinct populations characterized by either highly variable flows marked by stream drying and extreme temperatures or stable flows with consistent diel water temperature patterns. A laboratory experiment used videography to assess female reproductive output and distribution of fish from variable vs. stable environments. An experimental manipulation of male and female origin was conducted to characterize the role of female choice. Significant differences were observed in total reproductive effort (1.84 times more eggs per nest) between variable and stable populations. The distribution of eggs among nest-holding males suggested either local adaptation or phenotypic plasticity to variable environmental conditions can impact patterns of reproductive effort. These results highlight the importance of understanding local adaptations and the importance of maintaining population structure integrity

Current status of historic and stocked locations of Little Colorado Spinedace

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Oral Presentation

Little Colorado Spinedace are a small minnow that live in north flowing tributaries to the Little Colorado River. They were listed as federally threatened in 1967 with critical habitat finalized twenty years later in 1987. Since the listing various efforts have been made to increase Spinedace habitat and population numbers. During the early 2000's lots of effort was put into the recovery of LC Spinedace by Fish and Wildlife Service, Forest Service, and Arizona Game & Fish, but due reprioritization of other species LC Spinedace had not been heavily surveyed for since 2009. This presentation will focus on 2016 multi-agency effort to survey Little Colorado Spinedace sites combined with a summary of historic surveys. Although some historic sites in the Nutrioso Creek drainage contained low numbers of fish and increased non-native predators, creeks in the East Clear Creek drainage had abundant numbers of LC Spinedace in both historic and stocked localities. This discovery provides a hopeful future for stocking of Little Colorado Spinedace into streams within their historic range.

Age-0 Colorado Pikeminnow Captures in the San Juan River – 2016

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Oral Presentation

Small-bodied fishes monitoring in the San Juan River is designed to assess the densities of small-bodied native and nonnative fishes and the recruitment of large-bodied native fishes, in particular endangered Colorado Pikeminnow and Razorback Sucker. In 2016, 23 wild age-0 Colorado Pikeminnow were captured during small-bodied fishes monitoring, the first wild post-larval age-0 Colorado Pikeminnow to be captured in the San Juan River since the current monitoring protocol was initiated in 1998. Captures occurred in only the lower portion of the river (Geomorphic Reaches 2 – 4) and in zero or near-zero velocity habitats. High spring runoff (> 8,000 cfs) in 2016 was a likely cause of increased survival of larval to post-larval age-0 Colorado Pikeminnow in the San Juan River. Preliminary data on the captures will be presented and their implications discussed.

Evaluation of Spikedace and Loach Minnow Repatriation and Monitoring

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Oral Presentation

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, 16,022 Spikedace have been stocked while 4,837 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.

San Juan – Friday, February 10th 8:20 – 10:00 AM

Are Hatchery Reared Rainbow Trout and Brown Trout Effective Predators on Native Fish?

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Oral Presentation

Most hatchery reared trout have never eaten anything other than commercially prepared feed pellets, and yet it is commonly assumed that hatchery trout will adversely impact juvenile native fish through predation after stocking. We evaluated this assumption by comparing the predation effectiveness of wild-caught Rainbow Trout (210-389 mm TL) and Brown Trout (185-310 mm TL) to hatchery-reared Rainbow Trout (203-304 mm TL) and Brown Trout (196-290 mm TL) in laboratory experiments. We used captive-bred Humpback Chub (27-40 mm TL), Roundtail Chub (40-65 mm TL) and Bonytail (60-85 mm TL) as prey in overnight predation trials. Hatchery trout in 2013 were tested immediately after transport from the fish hatchery and then re-tested again after two weeks of being fed exclusively fathead minnows. In 2016, the experiment was repeated with hatchery rainbow trout being tested immediately after transport as well as after eating only fathead minnows for two weeks and four weeks post transport. Although hatchery trout readily consume fathead minnows, when fed at the surface in a fashion similar to pellets, they were largely unable to catch and eat chub that had been acclimated to test tanks. Our results indicate that both rainbow and brown trout reared in hatcheries pose little predation threat to native chub species for at least two weeks post stocking. Lack of experience catching and eating live fish and poor swimming ability because of fin erosion appear to make hatchery trout relatively inefficient predators on live fish for at least two weeks post-stocking.

Humpback Chub – range expansion in the lower Grand Canyon or better sampling?

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Oral Presentation

The Humpback Chub, Gila cypha is an endangered fish endemic to the Colorado River Basin. Standardized long term monitoring of the Colorado River between Glen Canyon Dam and Lake Mead has been occurring since about 2000 by various entities. Nighttime boat electrofishing has been the primary

method of sampling native and nonnative fish during this monitoring. Most of this monitoring occurred between river mile zero at Lees Ferry and Diamond Creek, river mile 225. Below Diamond Creek the Colorado River was essentially part of Lake Mead for many years. In more recent years with declining water levels the Colorado River has extended well past Diamond Creek to Pearce Ferry (RM 281.4) and beyond. Subsequently Arizona Game and Fish Department monitoring has extended to Pearce Ferry in recent years (2011-current). While electrofishing has not been very successful at capturing adult Humpback Chub, we do capture a small number of chub and with the recent (2016) addition of riverwide hoop net sampling we have documented Humpback Chub in the Western Grand Canyon. Additionally these Humpback Chub captured in the Western Grand (> RM 220) Canyon were not recaptures, whereas around 80% of Humpback Chub captured around the Little Colorado River inflow area were recaptures. This suggests that perhaps Humpback Chub in Western Grand Canyon are not utilizing the Little Colorado River for reproduction and might constitute a new "aggregation".

Genetic lineage assessment of unknown and rediscovered Gila topminnow (Poeciliopsis occidentalis)

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Oral Presentation

The Gila topminnow (Poeciliopsis occidentalis) is a small short-lived, live-bearing fish that spends most of its time close to the water's surface. It was once considered one of the most abundant fish species in the Gila River basin, but is now found in only a few watersheds in southeastern Arizona. As a result of habitat loss, fragmentation of adequate shallow-waters, and the introduction of non-native species, populations of Gila topminnow rapidly declined, and this species was federally listed as endangered in 1967. The objective of this study was to determine the lineage of origin of 22 topminnow samples of unknown lineages. Gila topminnows were rediscovered in the in the Santa Cruz River in southern Arizona after a ten-year absence, during an annual survey conducted by Arizona Game and Fish Department and other partners. We used primers for five microsatellite loci shown to be polymorphic in Gila topminnow to genotype samples and perform an exclusion/inclusion analysis to match or exclude alleles to one of the 13 known Gila topminnow lineages. Results of this analysis will be presented at the conference. Determining the most likely origin of the samples will aid the recovery efforts for the endangered Gila topminnow by allowing managers to make informed decisions regarding translocations or re-establishment of extirpated populations.

What's in a Map? A multi-criteria approach for fisheries management planning at the watershed scale

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Oral Presentation

Like many other state wildlife agencies, the Arizona Game and Fish Department is challenged with maintaining and enhancing sport fishing opportunities while also managing for the conservation and recovery of Arizona's native aquatic wildlife, including federally listed species. AZGFD has recently completed its first watershed-based fisheries management plan, using a decision-making framework that balances the agency's dual mandates of providing sport fishing opportunities while conserving native

aquatic species. The planning process aims to resolve conflicts that threaten the persistence of native aquatic populations by developing management recommendations that maximize opportunities for both sport fishing and native aquatic species conservation through a multi-criteria scoring approach. Using the recently completed Verde Watershed, the interagency planning process and criteria will be covered, as well as a demonstration of the web mapping application developed by AZGFD to communicate management objectives to agencies, NGO's and the public