Fisheries Abstracts

Poster Presentation

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First year's evaluation for three different feeds for rainbow trout in Arizona state hatcheries

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The Arizona Game and Fish Department (AGFD) invests substantial resources to produce healthy trout to meet fishing demands. Greater than 69% of Arizona angler's fish for trout and natural reproduction often cannot keep up with angler demand. The most produced fish for recreational fishing in Arizona is the rainbow trout (*Oncorhynchus mykiss*) and AGFD has seen an increase in mortality in recent years, mainly in the early life stages (fry and fingerling). The main objective of this project is to determine if different diets can mitigate mortalities caused by disease. Nutrition at early life stages is critical for growth, condition and survival to make thriving adults. We collected data on site to evaluate three different types of feed (Rangen®, BioOregon®, and BioOregon® with probiotic) to determine their impact on hatchery production for early life stages of trout reared in Arizona hatcheries. Preliminary results from first year data collection are that there were no significant patterns in mortalities between diets. We did see a difference between weights of fry (indoor trials) and fingerlings (outdoor trials). This project will continue until fall of 2018.

Abundance of Aquatic Vegetation in Central Arizona Streams

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The presence and abundance of aquatic vegetation of streams in arid regions is relatively unknown, particularly in Arizona. Macrophytes provide habitat, food sources, and nutrients to aquatic organisms. In order to understand the scope of macrophyte contributions to stream ecosystems, we determined the relative presence of aquatic vegetation across four Arizona streams. We randomly placed electrofishing devices at 1,200 prepositioned aerial quadrats at 36 access points across the Blue river, the Verde river, Tonto Creek, and Eagle Creek, all located in the central Arizona area. The percentage of the area covered by aquatic vegetation was estimated in each quadrat. Each quadrat was defined either as a riffle, run, or pool to determine if macrohabitat has an influence on aquatic vegetation presence. We compared the abundance of aquatic vegetation between the four streams by quantifying the percentage of access points that had the presence of aquatic vegetation and then taking the global average of these values. The

abundance values of all four streams and the global value were relatively low. We then looked at the proportion of quadrats that had aquatic vegetation in each of the three macrohabitat categories. Pools had the highest percentage of quadrats with vegetation. These data are important for managers to understand how macrophytes may contribute to various aquatic systems in arid environments like Arizona and learn how to preserve them.

Establishment of a reproducing population of Humpback Chub through translocations to Havasu Creek, Grand Canyon

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Endangered Humpback Chub (*Gila cypha*) persist as a self-sustaining population in Grand Canyon, Arizona, despite habitat alterations following the construction of Glen Canyon Dam, and the introduction of nonnative competitors and predators. The species has been sustained primarily through reproduction in a single spawning aggregation centered on the Little Colorado River and its inflow reach of the Colorado River. To minimize risk to the population, the National Park Service, with funding from the U.S. Bureau of Reclamation, initiated a series of translocations of juvenile Humpback Chub from the Little Colorado to Havasu Creek, a Colorado River tributary, to establish a second spawning population and provide an additional rearing opportunity. Translocations of between 242-509 juvenile fish to Havasu Creek were conducted annually between 2011 and 2016. Abundance, apparent survival, and growth rates were analyzed through biannual mark-recapture sampling, to assess the success of the translocations in reaching project objectives, which included a comparative analysis against published vital rates for the source population. Apparent survival and growth rates met or exceeded published values for juvenile Humpback Chub in the Little Colorado River. Fish in spawning condition were observed each year in May, beginning in 2012. Untagged juveniles were captured the following year, and every year thereafter, indicating reproduction had occurred. Recruitment to maturity of non-translocated fish was noted in 2016 and 2017, indicating the potential for the establishment of a self-sustaining population. The Havasu Creek population will continue to be monitored in the future, and augmentation is planned to maintain genetic integrity.

Effects of Riparian Cover on Fish Habitat Use

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Riparian canopy has been shown to be beneficial to instream fish habitat because it provides shading and bank stability. Canopy cover allows streams to maintain suitable fish habitats by preventing water temperature fluctuations and improving channel morphology. Certain species of fish may be negatively affected by a lack of vegetation cover because of an increased temperature range. In order to understand the effect of shading from canopy cover on the fish species in the Verde River, we accessed twelve sites along the upper and middle Verde River in central Arizona. Thirty pre-positioned areal electrofishing devices (PAEDs) were randomly placed throughout each site and were used to sample fish. Microhabitat was also measured at each grid, including canopy cover, which was calculated using a spherical densiometer. This data was analyzed to determine if there is a relationship between canopy cover and water temperature and species of fish. We expected to see a difference in microhabitat use based on canopy cover vary among species. It is important to know the relationship between canopy cover and fish species to manage riparian areas to benefit certain species accordingly.

Bonytail, the Arizona tuna: convergence in muscle and tendon anatomy in scombrids and *Gila cypha*

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Bonytail (*Gila elegans*) are an Arizona native endangered species that have unusual morphology thought to have evolved as an adaptation to high-flow riverine environments. The shallow peduncle and crescent shaped tail may minimize drag and increase swimming efficiency. Here we describe anatomical features associated with the distinctive shape of the caudal peduncle in Bonytail and compared peduncle morphology to two closely related native species, Roundtail (*Gila robusta*) and Humpback chub (*Gila cypha*). We measured the neural and hemal vertebral spine angles (angle the spine creates with the vertebral centra) and size normalized spine lengths (spine length/standard length of fish) of the last twelve vertebrae in representatives of all three species. Bonytail have much more acute spine angles (~20°) in the caudal peduncle when compared to Humpback and Roundtail. When we examined the soft tissues (muscle and tendon) of the caudal peduncle we found evidence for paired lateral tendons in Bonytail that may be absent in other *Gila* species. In addition, the total volume of muscle in the peduncle region of Bonytail appears to be reduced when compared to Humpback and Roundtail Chub. Reduced musculature and red-muscle tendons are also present in scombrid (tunas) fishes, where long lateral tendons transmit force from the anterior musculature directly to the tail. For Bonytail, this morphology was likely advantageous during historic seasonal flooding events, where they could maintain position in the flow with relatively low energy expenditures.

Feasibility of using meristic counts and mouth characteristics to identify Razorback Sucker Flannelmouth Sucker hybrids

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The Razorback Sucker and Flannelmouth Sucker are two catostomid species endemic to the Colorado River Basin. Razorback Suckers were listed as endangered in 1991 due to habitat alteration and predation

by nonnative fishes. Hybrids between the two catostomids have been described as early as 1889. Hybrids have similar hatch success and larval survival as pure Razorbacks and Flannelmouths. To properly monitor the recruitment of wild Razorback Suckers, field biologists need to be able to accurately discriminate young Razorbacks from Flannelmouths and hybrids. Shape is generally used to identify fishes, but Razorbacks, Flannelmouths, and their hybrids cannot be accurately identified when they are smaller than 137 mm total length by using shape alone. To aid in field identification of these smaller size classes, we investigated the differences in dorsal and anal fin ray counts as well as differences in mouth part characteristics. We found that both Razorback Suckers and hybrids had on average 15 dorsal fin rays and 9 anal fin rays. Based on the literature, Flannelmouth Suckers have 12 dorsal fin rays and 7 anal fin rays. Of the Razorbacks, 96% had completely separate lower lip clefts and 71% had wide lower lip notches. The majority of hybrids (85%) had completely separate lower lip clefts and 80% had narrow lower lip notches. We counted the number of papillae that spanned the clefts of the lower lip, but it wasn't useful for identification. We were unable to compare the mouth structure of Flannelmouths due to a lack of specimens.

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

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Hatchery-reared Rainbow and Brown Trout are typically fed exclusively on commercially prepared pelleted feeds and have no experience catching or consuming live fish. Despite this lack of predation experience, it is commonly assumed that hatchery-reared Rainbow Trout and Brown Trout will adversely impact native fish populations when stocked into natural environments by preying upon juvenile native fishes. We evaluated this assumption by comparing the effectiveness of wild-caught Rainbow Trout (210-389 mm TL) and Brown Trout (185-313 mm TL) to hatchery-reared Rainbow Trout (198-321mm TL) and Brown Trout (196-290 mm TL) in laboratory predation experiments. We used Bonytail (60-85 mm TL), Humpback Chub (24-59 mm TL), and Roundtail Chub (40-65 mm TL) and as prey in overnight predation trials. Rainbow Trout and Brown Trout born and reared in the wild were relatively effective predators on juvenile fish, typically consuming over 70% of prey in our laboratory trials. Both species of hatchery-reared trout would readily consume fathead minnows, when fed at the surface, without acclimation, in a manner similar to methods used when feeding pelleted feed, but were largely unable to catch juvenile chub during our more natural laboratory predation experiments typically consuming less than 30 % of prey. Our results also suggest that Rainbow Trout and Brown Trout reared in hatcheries do improve in their ability to catch and eat small chub over time but still likely pose little predation threat to juvenile native chub species for up to 30 days post stocking. Lack of experience catching and eating live fish, poor swimming ability, and the effects of captive rearing environments on both physiology and behavior appear to make hatchery trout relatively inefficient predators on live fish and may limit predation impacts on native fish, especially in locations where return to creel is high and stocked fish do not persist in the environment.