

1) Presentation Type: Poster

Title: Variation in Characteristics among Gizzard Shad Populations: The Role of Impoundment Size and Productivity

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Abstract: Population characteristics of gizzard shad *Dorosoma cepedianum*, an ecologically important fish species in Midwestern and southern USA impoundments, demonstrate considerable variation among water bodies. Impoundment productivity is known to influence these population variables (e.g., recruitment, growth, mortality, size and age composition) but the role of impoundment morphometry (e.g., surface area, depth) is unknown. Differences in population characteristics of gizzard shad were compared between large and small impoundments across an impoundment-productivity gradient (indexed by total phosphorus [TP] concentration). Populations shifted from those comprised mostly of low abundances (indexed by catch-per-unit effort [CPUE], fish/hour of electric fishing) of long-lived, large adults to those comprised of high abundances of short-lived, small adults as TP increased. However, the trends in population variables across the TP gradient were less apparent in small impoundments than in large impoundments owing to considerable variation at a given TP level. Further analysis revealed that CPUE of gizzard shad was lowest in the smallest impoundments (< 33 ha surface area) regardless of TP concentrations, probably because of more frequent winter kills. Overall, population characteristics were influenced by both density-dependent effects and impoundment characteristics. Characteristics of gizzard shad were highly variable among populations, which have important consequences for ecosystem structure and function.

2) Presentation Type: Poster

Title: Immune Function and Hibernation Energetics of Three North American Bat Species with White-Nose Syndrome

Authors: Briana Anderson, Tom Tomasi, Christopher Lupfer

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Abstract: White-nose syndrome (WNS) causes substantial mortality in certain species of hibernating North American bats. The responsible agent is *Pseudogymnoascus destructans* (*Pd*), a fungus which causes physiological complications such as increased arousals and energy depletion during the hibernation season. Elevated immune responses have been observed in torpid *Pd*-infected bats, which could be a possible attempt at defense against the fungus. Tri-colored bats (*Perimyotis subflavus*) and northern long-eared bats (*Myotis septentrionalis*) suffer extensive WNS mortality, while gray bats (*Myotis grisescens*) are infected, but mortality is rarely observed. It is hypothesized that there is a difference in immune responses and/or hibernation metabolism between these bat species, resulting in this interspecific variation in disease severity. To test these hypotheses, experiments were conducted at both the cellular and whole-bat level. Wing tissue cells (fibroblasts) were cultured and infected with *Pd*, and we assessed levels of 14 immune signaling proteins that were expressed in response to infection. Also, live tri-colored bats were brought into the lab, infected with *Pd*, and tested for torpor energetics and immune function throughout the hibernation season. Results are currently being analyzed. This study has the potential to explain interspecific differences in WNS disease severity, which could assist in establishing treatment and conservation strategies for North American bats. In addition, we are pioneering a cell culture method to address WNS-questions without using live bats; this will allow researchers to address a myriad of questions, such as which western bat species might be most susceptible to WNS as it spreads westward.

3) Presentation Type: Poster

Title: Monitoring flow and pollutant loading at nested-scales in a mixed-land-use watershed of the central United States

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Abstract:

The effects of land use on flow and pollutant loading regimes are poorly understood in mixed-land-use watersheds. Water quantity and quality was monitored at five stream sites using a nested-scale experimental watershed study design in a rapidly urbanizing mixed-land-use watershed of the central USA. Agricultural land use decreased by 18.4% and urban land use increased by 21.6% from the headwaters toward the watershed outlet. Four years of grab samples were collected at each site ($n=836$ samples per site) and analyzed for suspended sediment, total phosphorus, and inorganic nitrogen species during the study period (2010 – 2013). Daily flow and load duration curves were generated to quantify daily flow and pollutant yields at multiple flow intervals. Greater than 92.1% of the total pollutant loads were transported during the high flow interval (0-10%). Less than 0.1% suspended sediments and less than 1.0% TP-P were transported during mid-range conditions (40-60%). Concentrations of $\text{NO}_3\text{-N}$ exceeding 5.0 mg L^{-1} were observed during moist conditions (10-40%) when median daily flow was $0.06 \text{ m}^3 \text{ s}^{-1}$ in the agricultural headwaters. The eutro-mesotrophic boundary was exceeded by 37.8% ($\text{NO}_3\text{-N}$ in the agricultural headwaters) to 182.2% [(suspended sediment near the watershed outlet where urban land use accounted for 26% of the total drainage area (207.5 km^2))] during the high flow interval. The eutro-mesotrophic boundary was exceeded by 56.3% for suspended sediment near the watershed outlet during moist conditions. Results highlight a critical need for pollutant monitoring at multiple flow intervals to capture the variability of pollutant loading in mixed-land-use watersheds.

4) Presentation Type: Poster

Title: The Impacts of a Low Water Crossing on Fish Movement in an Ozark Stream

Author: Jeff M. Williams, Hope R. Dodd, Debra S. Finn, Payton G. Lackman

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Abstract: Streams are complex branching networks that rely on longitudinal (upstream/downstream) connectivity to maintain ecosystem function. Road crossings can variably impact longitudinal connectivity of fish populations, therefore, it is ecologically important to evaluate the effects of potential barriers on fish movement. The Current River in Ozark National Scenic Riverways contains a single low-water crossing on the main channel and a side channel that may act as a barrier to fish movement. A study is underway to observe the movement behavior of two species, Northern Hogsucker (*Hypentelium nigricans*) and Knobfin Sculpin (*Cottus immaculatus*), within close proximity to the crossing. We hypothesized that the low-water crossing 1) prevents upstream movement during low-flow conditions, 2) reduces the total upstream movement for fish below the bridge compared to those upstream of the bridge and 3) has greater impacts on upstream movement of smaller, less powerful fishes than larger fishes. To test these hypotheses, we tagged 300 sculpin and 47 suckers in July of 2017 with PIT and radio tags respectively and released all fish within close proximity to the crossing (Above: 24 suckers, 131 sculpin; Below: 23 suckers, 169 sculpin). Tagged fish are being tracked monthly over the course of a year. Preliminary results support our hypothesized differences in species size response to the crossing. Three months into the study, we have evidence of upstream passage in suckers but not sculpin. Future analysis will tell us whether the crossing is impacting the total upstream movement of fish below the bridge.

5) Presentation type: Poster

Title: Stegall Mountain: 25 years of multi-agency landscape scale fire

Authors: Calvin Maginel, Megan Buchanan, others

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Abstract: Stegall Mountain consists of a complex of igneous glades and surrounding woodlands that have been under fire management for 25 years, and data from varied groups of organisms have been collected throughout this time frame. We discuss early results of re-sampling avian, grasshopper, collared lizard, ground flora, and overstory communities on this unique natural area and correlate observed changes with landscape-scale fire treatments.

6) Presentation Type: Poster

Title: Potential Impact of Feral Hogs on Western Cottonmouth Populations at Mingo National Wildlife Refuge, Missouri

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Abstract: Feral hogs (*Sus scrofa*) are an invasive species that can outcompete native species and cause significant environmental damage leading to indirect impacts among native communities. This is primarily due to the effects (e.g., vegetation loss and delayed succession) hogs cause to community health and function. The aim of this study was to determine if *S. scrofa* prey on Western Cottonmouth (*Agkistrodon piscivorus*) populations during snake egress and ingress to hibernacula within the Mingo National Wildlife Refuge (MNWR), Missouri. In order to observe direct interactions between Western Cottonmouths and feral hogs, 16 camera traps were placed at selected snake hibernacula (one facing towards hibernacula and one facing away) during movement periods (February to April and September to October). Additionally, stomach contents of culled feral hogs (collected in MNWR or neighboring lands) were examined to determine if any individuals preyed on Cottonmouths. Preliminary data suggests feral hogs and Cottonmouths share areas of distribution. Interactions between snakes and hogs in addition to management implications for hogs will be discussed. Additionally, current data could indicate changes in trophic-level dynamics for the future.

7) Presentation Type: Poster

Title: Validating the taxonomic and distributional status of the Neosho Smallmouth Bass (*Micropterus dolomieu velox*)

Authors: [Joe C. Gunn¹](#); Leah K. Berkman²; Lori S. Eggert¹

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Abstract: Black Bass (genus *Micropterus*) are not only ecologically important, they are highly sought-after among anglers. Thus, stocking has become increasingly common. Nine species and several subspecies are currently recognized, but descriptions are based primarily on morphology, and we lack strong genetic evidence to support the present taxonomy. One area of controversy involves the relationship between the two subspecies of Smallmouth Bass (*Micropterus dolomieu*). These variants are identified by the number of soft dorsal fin rays, predorsal contour, and the presence or absence of teeth along the tongue. Despite known morphological differences, the taxonomic relationship between the Northern Smallmouth Bass (*M. d. dolomieu*), which inhabits most of central North America, and the Neosho Smallmouth Bass (*M. d. velox*), whose native range is restricted to the Central Interior Highlands, has not been adequately resolved on a genetic level. Because intermixing of genetically unique populations can lead to hybridization or, in extreme cases, loss of genetic integrity and loss of species-wide diversity, it is vital to consider *M. dolomieu* biodiversity when restocking *M. dolomieu*. We investigated the taxonomic and distributional status of *M. d. velox* in Missouri, Arkansas, and northeastern Oklahoma using 15 microsatellite loci. We assessed levels of genetic differentiation among samples collected from the Arkansas River Basin and evaluated their taxonomic distinction. Our results lay the groundwork for an investigation of hybridization between *M. dolomieu* subspecies using genomic methods and for delimiting the ranges of the diverged forms.

8) Presentation Type: Poster

Title: Characterizing Stream Habitat Availability Using Level Loggers and Time Lapse Photography

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Abstract: The composition of stream fish communities is largely shaped by the structure and availability of stream habitat. Stream systems are dynamic and only a snapshot of stream conditions can be achieved in a single visit. To better characterize stream habitat a longer record of conditions may be valuable. We developed a method of quantifying the temporal availability of stream habitat types in 6 wadeable streams in the South Fork of the Salt River drainage basin, MO. We completed a survey of bed elevation using a laser level every 1 m along the thalweg, and at points spaced one meter apart between high banks along transects which were measured at every fifth thalweg measurement. We coupled this with readings from level loggers placed in two pools that recorded depth every 15 min, and time lapse photography of two riffles at each study site. A calibration photograph was taken with a grid over the stream so that wetted width could be calculated and linked to stage. We were able to calculate the average and minimum water volume, wetted width and depth for each habitat unit from June to September 2017. Average wetted width across all sites was approximately 4 meters. Due to stream drying sites ranged from 95% wetted to 10% wetted length in late September. High flows increased water depth by over 3 meters following an 18 cm precipitation event. Our study provides a low-cost method to measure coarse-scale stream habitat metrics when river gage data are unavailable.

9) Presentation Type: Poster

Title: Habitat associations of endemic crayfishes in the Meramec River drainage: the Freckled Crayfish (*Cambarus maculatus*) and Belted Crayfish (*Faxonius harrisonii*).

Authors: Joe Chilton & Dr. Amanda E. Rosenberger

Affiliation: Missouri Cooperative Fish and Wildlife Research Unit; University of Missouri, School of Natural Resources. Dr. Amanda E. Rosenberger: U.S. Geological Survey, Tennessee Cooperative Fisheries Research Unit; Tennessee Technical Institute.

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Abstract: Understanding the habitat associations of rare species is important to make informed management and policy decisions. The Freckled Crayfish (*Cambarus maculatus*) and Belted Crayfish (*Faxonius harrisonii*) are two of Missouri's rare and endemic crayfish species. Both species are listed as "vulnerable" on Missouri's list of species and communities of conservation concern due to their limited range. Their native range is limited to the Meramec River drainage in eastern Missouri. In our study, we sampled 60 different sites throughout the Freckled Crayfish and Belted Crayfish's known range for presence and habitat variables. Replication was performed spatially within sites using kick-seines, drag seines, and visual timed-searches. Freckled Crayfish and Belted Crayfish were captured at 24 and 26 sites, respectively. Local and landscape-scale habitat variables were evaluated through occupancy modeling with the R package "unmarked". Occupancy modeling accounts for imperfect detection, which is common when sampling for rare species. This study hopes to inform conservation managers on what habitat parameters are the most influential to the existence of these two endemic crayfish species.

10) Presentation Type: Poster

Title: Characterizing the species richness using three gears used for invasive carp sampling.

Authors: Jack Niemeyer*, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Chris Brooke, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Emily Pherigo, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Jahn Kallis, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Josey Ridgway, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Office; Jeremy Hammen, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Bryon Rochon, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Jason Goeckler, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Wyatt Doyle, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office

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Abstract: Silver Carp are an invasive species that were introduced to the United States in the 1970's and have expanded throughout the Mississippi River and tributaries. Management and monitoring of Silver Carp has been difficult due to the inability to effectively capture them. In areas of the Missouri River basin where the very nature of the system can be difficult to sample, it is essential to have a variety of techniques available to assess Silver Carp populations and the associated fish communities. In 2016 and 2017, two electrotrawling techniques, (electrified dozer trawl and electrified butterfly trawl) were compared to traditional electrofishing methods currently being used for management and monitoring of Asian carp. As part of this gear evaluation study, samples were taken at random; all fish were identified to species and enumerated. The mean species richness per 5 minute transect for electrified butterfly trawl, electrified dozer trawl and traditional electrofishing were 7.75 (n=305; SE=0.149), 5.24 (327; 0.177) and 3.37 (322; 0.228), respectively. Excluding Silver Carp, Gizzard Shad and Threadfin Shad were the most abundant species for all gear types, accounting for 79% of fish captured by the electrified butterfly trawl, 85% for the electrified dozer trawl and 77% for traditional electrofishing. In addition to assessing Silver Carp populations, novel electrotrawling gears have further utility beyond Silver Carp sampling and have the potential to assess pelagic fish communities.

11) Presentation Type: Poster

Title: Silver Carp mass removal: applications for the Mississippi River Basin

Authors: Zachary Sanders, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Josey Ridgway, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Emily Pherigo, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Wyatt Doyle, Columbia Fish & Wildlife Conservation Office, U.S. Fish & Wildlife Service; Jason Goeckler, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Kevin Drews, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Ryan Long, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office

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Abstract: To reduce the number of Asian carp downstream of the electric dispersal barrier on the Illinois River, mass removal efforts, referred to as barrier defense, are coordinated spring through late fall in the Starved Rock and Marseilles pools by Illinois Department of Natural Resources. The USFWS Columbia Fish and Wildlife Conservation Office (FWCO) has participated in these efforts using an electrified butterfly trawl which captures a wide size range of Asian carp from a variety of habitat types. In 2016, the Columbia FWCO fished 16 days and removed 11,103 Silver Carp at a rate of 707 Silver Carp/electrotrawling hour. In an effort to increase removal efficiency, daily operations (i.e., gear set-up/take-down, searching for fish, electrotrawling time, emptying nets, and gear repair) were tracked and assessed in 2017. With the addition of a tender boat, mechanical winches, and other improvements, Silver Carp catch rates increased to 2,129 Silver Carp/electrotrawling hour. In terms of labor hours, approximately 62 Silver Carp per labor hour were removed in 2016 whereas approximately 91 Silver Carp/labor hour were removed in 2017. Current results indicate majority of time (~35%) is expended removing fish from nets. Mechanisms to reduce handling fish are in development which includes upgrading net cods and adding winches to the tender boat. This assessment will improve efficiency of the electrified butterfly trawl as a mass removal tool for Asian carp management and control in the Mississippi River Basin.

Tags/Keywords: Exotic/Invasive Species, Fisheries Techniques, Management

12) Presentation Type: Poster

Title: Silver Carp diel sampling: applications for invasive carp management in the Mississippi River Basin

Authors: Bryon Rochon, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Josey Ridgway, U.S. Fish & Wildlife Service Columbia Fish & Wildlife Conservation Office; Jeremy Hammen, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Emily Pherigo, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Jason Goeckler, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Wyatt Doyle, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office;

Affiliation: USFWS Columbia FWCO

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Abstract: Silver Carp, an invasive species found in river systems and reservoirs throughout the Mississippi River Basin, are notoriously difficult to capture making it problematic to assess populations. Recent evidence suggests Asian carp frequent the upper water column after sunset, which could increase their vulnerability to capture. The USFWS Columbia Fish and Wildlife Conservation Office used an electrified butterfly trawl to determine when Silver Carp catch rates peak over a diel cycle and season. Sampling occurred in two reservoirs (Kentucky Lake and Lake Barkley, Kentucky) and two large backwaters of the Illinois River (Hanson Material Services, Marseilles Pool, Illinois) in spring, summer, and fall of 2017. Randomized transects (5 min trawls at 5 km/h) were sampled continuously through the evening, two hours pre-sunset and five hours post-sunset. Preliminary data has shown that Silver Carp catch rates increase throughout the evening and peak 2-4 hours after sunset in both a reservoir and backwater habitats. Plateaus in Silver Carp catch rates sustained for 2-3 hours and then began to decrease into the morning. Catch rates were 2-3 times greater during these peak times compared to the 2 hours prior to sunset. When field data collection is complete, seasonal effects will be assessed. Current Asian Carp collections occur during daylight hours (e.g., traditional electrofishing). However, evidence here suggests Silver Carp catch rates can be substantially improved when sampling after sunset.

Tags/Keywords: Asian carp, diel, invasive carp management

13) Presentation Type: Poster

Title: Historic and Latitudinal Comparison of Testes and Gonopodium of Male Mosquito Fish (*Gambusia affinis*)

Authors: Michael Frangello 1 , Kurtis Dean 1 , Aaron Geheber, 1 Jennifer Mittelhauser 1 , Cassandra Pauling 1 , and Dustin Siegel 2

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Abstract: Western mosquito fish (*Gambusia affinis*) are widespread and abundant due to anthropogenic introduction. In North America, they can be found in southern river drainages (Louisiana, Texas, Alabama, and Mississippi), Northern drainages (Cook County, Illinois), and as far west as the Rio Grande and Pecos Rivers . The aim of this study is to determine if there is variation in sperm production and gonopodium length in *G. affinis* over a temporal and latitudinal gradient. Museum specimens underwent measurements consisting of total length, gonopodium length, testes dimensions, and sperm production across time and latitudes. Calculating gonadosomatic index and using histochemical techniques reinforced sperm production evaluations. This provided insight into species-specific reproductive patterns and detection of any changes that may be occurring. The temporal aspect of this study was performed on *G. affinis* collected from a single site in the Pearl River located in Louisiana. Mosquito fish from two more museums across the central part of the range were examined and compared for the latitudinal aspect. Results are to be discussed at a later date.

14) Presentation Type (Oral or Poster): Poster

Title: Stream size influences relationships between fish abundance and watershed landscape, instream habitat, and biotic interactions in the Missouri Plains and Ozarks

Authors (Underline Presenter): Cheyenne Stratton, Nick Sievert, Craig Paukert

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Abstract: The relationships between environmental and biotic factors and fish community structure within waterbodies is important for the conservation and management of aquatic resources. Freshwater biodiversity is at risk of decline due to a variety of threats. Understanding how fish community structure are influenced by abiotic and biotic habitat conditions at multiple spatial scales can help guide managers and decision-makers in their efforts related to stream fish conservation. This study aims to evaluate the degree to which watershed landscape, instream habitat, and biotic interactions shape the fish community in headwaters, creeks, and small rivers in the Ozark and Plains regions of Missouri. We used partial redundancy analysis to determine the proportion of the total variation in fish abundance data explained by each of the three factors independently and in conjunction with each other. Fish community and instream habitat data was provided by the Missouri Department of Conservation's Resource Assessment and Monitoring Program database. Landscape-level data was provided by the Missouri Resource Assessment Partnership. By identifying which factors are influential in structuring fish communities in different sized streams we can guide management actions. For example, in streams where biotic interactions appear to be most influential, it may be most important to manage and prevent invasive species introductions. While in systems where landscape-scale effects are the most important, emphasis should be on watershed landscape conservation, or when instream habitat is the most important factor, stream channel restoration may be a priority.

15) Presentation Type: Poster

Title: Song rates of a migratory Neotropical/Nearctic warbler species at stopover sites in west-central Missouri

Authors: Daniel Akin and Kurt Dean

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Abstract: The Tennessee Warbler (*Oreothlypis peregrina*) is a small warbler species that breeds in forest habitat to the north of Missouri and winters in Central and South America. This species is observed over a brief period during spring migration (late-April to mid-May) where it frequents forested areas and urban woodlands. Male Tennessee Warblers are of interest to us due to their consistent and constant song rates while foraging at stopover sites. This high song constancy is uncommon in other migratory warbler species that appear to primarily forage and sing sparsely at stopover sites. This species is also interesting in that males are producing active sperm at our latitude but the females have yet to begin sperm tubule recrudescence. This dichotomy leads to an asynchrony in reproductive activity with song rates (used to attract females, defend territory) occurring at latitudes where breeding does not occur. This is intriguing from an energetic standpoint because if a bird is singing it cannot be feeding. A singing bird also brings attention to itself vis-à-vis predators. It is possible that individuals are such efficient foragers that they can meet their energetic needs and still manage to sing with high frequency and constancy. We are interested in individual male song rates and how they relate to time of day, time of migratory period, forage availability and distance to other singing conspecifics. We observed 186 singing male Tennessee Warblers between 28 April and 14 May 2017. In addition, we sampled available arthropods/tree on 10 of the observation days.

16) Presentation type: Poster

Title: Differential microhabitat use among three co-occurring sculpin species (Cottidae)

Authors: Samantha Holcomb and Aaron D. Geheber

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In communities, resource limitations (e.g., space and food) can lead to competitive pressures among ecologically similar species. At local spatial scales, species with similar needs may partition habitat resources to alleviate such pressures. Thus, a finer spatial focus is needed to examine potential differences in habitat use among co-occurring species. In the Gasconade drainage (Missouri), three species of sculpin (*Cottus carolinae*, *C. bairdi*, and *C. hypselurus*) co-occur. Sculpin are small bodied benthic fishes that dwell in cold water riffle areas. Due to general similarities in habitat use, we examined if co-occurring sculpin species are partitioning habitat to avoid (or as a result of) interspecific competition. Microhabitat measures included stream flow velocity, depth, substrate size, and spatial location within riffle segments. We compared microhabitat of sculpin species collected at stream sites, and tested for differential habitat use. Moreover, because morphology may be closely tied to ecological function, we examined relationships between species body shape and microhabitat use. Results suggest the existence of some differentiation among species based on microhabitat measures as well as morphological characters. The influence of interspecific competition on sculpin microhabitat use differences, and the implications of these results on future conservation efforts will be discussed.

17) Presentation Type: Poster

Title: Developing a 3D Digital Surface Model (DSM) of Ozark Hardwood Forest using UAV-based Aerial Photogrammetry Techniques

Authors: Tyler Bradford, Dr. Michael Goerndt, Dr. Xin Miao, Dr. Wenping Qiu, Jim Peterson

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Abstract: The content of this poster focuses on the steps in developing a three-dimensional digital surface model (DSM) of an area of Ozarks hardwood forest using innovative photogrammetry techniques. The development of a sufficient DSM for extracting canopy heights involves conducting UAS flights to obtain RGB aerial images of study site and constructing a DSM of the forest canopy using the built-in functions of Agisoft Photoscan. The accuracy of the generated DSM can later be assessed using *in situ* tree heights and other ancillary data. A subset of dominant and codominant trees were selected from each of several fixed-area plots and the heights were estimated using a high-precision laser rangefinder. This project is a component of a larger climate change study which uses both UAV-based hyperspectral and RGB aerial imagery to develop an accurate spatial-temporal model of the vegetative response to climate change in the Ozarks. If successful, the results of this substudy may improve current photogrammetry methods for processing UAV-based aerial images in temperate deciduous forests.

18) Presentation Type: Poster

Title: Geomorphic response to engineered log structures after a catastrophic flood event, North Fork of the White River

Authors: Joe Nash, Marc Owen, and Robert T. Pavlowsky

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Abstract (250 words maximum): In-stream large wood structures have been widely used in the Pacific Northwest as a river restoration technique. However, large wood structures have not been used in the Ozarks until recently. In October 2016 the U.S. Forest Service installed four engineered log structures (ELs) to stabilize banks at the North Fork Recreation Area in Ozark County, Missouri. On April 30, 2017 a catastrophic flood event occurred with a stage that reached approximately 14 feet above the previous record flood in 1985. The flood destroyed a highway bridge at the North Fork Recreation Area, and another highway bridge close to the mouth of the river at Norfork Lake. The objectives of this study are to compare pre-flood and post-flood surveys to: 1) analyze changes to bed and bank landforms, 2) determine large woody debris volume, and 3) evaluate the effectiveness of the ELs. Preliminary results show that there was a planform change where the thalweg position moved to the opposite side of the channel, large woody debris increased throughout the study reach, and deposition around the ELs was maximized by approximately 3.4m. The importance of this study is to understand how a catastrophic flood event affects localized geomorphology and evaluate the use of large wood as a restoration tool in the Missouri Ozarks.

19) Presentation Type: Poster

Title: Geologic influences on aquatic invertebrate community structure and integrity in Ozark tributaries at Buffalo National River, Arkansas and Ozark National Scenic Riverways, Missouri

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Abstract: Watersheds are influenced by local and regional environmental factors that affect surface flows, groundwater sources, and aquatic invertebrate communities. Geologic characteristics associated with karst topography play a key role in structure and function of Ozark Plateau streams, including water chemistry, hydrology, and temperature. Invertebrate data (2005-2016) and environmental factors collected from 55 wadeable tributaries of three Ozark rivers (Buffalo River, Arkansas, and Current and Jacks Fork Rivers, Missouri) were analyzed to determine geologic influences on invertebrate community structure and integrity. Additional local/regional environmental factors were examined. Preliminary results indicate major geologic differences between basins appear to influence community structure, but do not appear to determine overall community integrity. Invertebrate community metrics varied among tributaries and between basins with similar values for all three watersheds showing little indication of disturbance. Distinct basin groupings of taxa similarity in relation to geologic differences illustrate potential influences of geology on community structure. Gradual erosion of the Ozarks, inherent in their geology, could potentially influence invertebrate community structure; therefore, long-term monitoring is important for early detection of erosion and anthropogenic influences on the invertebrate community.

Keywords: Macroinvertebrate, geology, monitoring, environmental factors, Ozarks

20) Presentation Type: Poster

Title: Assessment of Expert Perceptions of Non-Native Insect Impacts: Implications for Policy and Management

Authors: [Ashley N. Schulz](#)¹ and Travis D. Marsico¹

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Abstract: Non-native, invasive insects often cause changes to the environment in which they are introduced. These changes are often characterized as “impacts,” and, depending on how severe they are, may have implications for risk assessment and management decisions. Severity of impact varies depending on perspective, but is commonly determined through interpretation of the work of experts that have researched specific non-native, invasive insects. In some cases, scientists do not clearly define the impacts, are uncertain about impacts, or cannot agree on an impact. This creates a trickle-down effect that may affect decision making and management. Here, we evaluated how scientists with differing levels of expertise assess the impacts of non-native conifer specialist insects. We had 15 scientists each evaluate nine non-native, conifer-specialist insects, and provide their level of expertise (1-5, where 1 is no expertise and 5 is high expertise) and level of uncertainty (1-5, where 1 is no uncertainty and 5 is high uncertainty) for each insect that they assessed. Of the 41 insects that were assessed, scientists completely agreed on 11, including the high-impact hemlock woolly adelgid (*Adelges tsugae*) and three low-impact species of pine needle aphids (*Eulachnus* spp.). Preliminary results suggest that variance in assessment peaked in medium impact insects, and increased with assessor expertise. Overall, vagueness or a lack of information in publications, or prior perceptions of an insect can lead to different interpretations of impact among experts, which can have lasting implications for decision making and resource allocation concerning management of invasive insects.

21) Presentation Type (Oral or Poster): Poster

Title: Hypomelanism Rates in a Captive Population of Alligator Snapping Turtles

Authors (Underline Presenter): Kristen E. Sardina¹, Denise M. Thompson², Rebecca Fillmore³, Brian M. Fillmore⁴, Kerry Graves⁴, and Day B. Ligon¹

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Abstract (250 words maximum): Hypomelanism is occasionally observed in both wild and captive populations of reptiles, but due to its rarity it remains a poorly understood phenomenon, particularly in chelonians. This trait is generally presumed to arise from genetic mutations and be maladaptive in wild populations because of the potential for both increased depredation due to reduced camouflage and altered immunological or metabolic function. This anomaly may be markedly detrimental to hatchling turtles that experience high rates of mortality during early life stages. The presence of congenital hypomelanism in alligator snapping turtles (*Macrochelys temminckii*) is characterized by pink skin freckled with black, light-colored keratin on the beak, plastron, and carapace, and white irises. Despite the wide recognition of this condition in *M. temminckii*, the frequency at which it occurs and potential deleterious effects associated have not been reported. In this study, we calculated the frequency and distribution of pink hatchlings in a captive breeding population of alligator snapping turtles. We also compared phenotypic features, incubation duration, growth rates, and survival rates of hypomelanistic morphs to those of normally pigmented turtles in the population. Understanding the patterns of occurrence and consequences of hypomelanism to individuals has important implications for conservation management decisions with respect to brood stock selection and head-start/reintroduction programs currently being applied for the species.

Category: Captive Management

22) Presentation type: Poster

Title: Nutrient transport in a karst spring-reservoir system during baseflow, Springfield, Missouri.

Authors: Heather A. Moule, Robert T. Pavlowsky and Marc R. Owen

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Abstract: Urban and agricultural land uses are important sources of nitrogen and phosphorus which, if in excess, can cause eutrophication in lakes and rivers. There have been few studies of nutrient transport and storage in stream systems draining the Ozark Highlands. In karst environments, springs can quickly and easily transport nutrients to watersheds. This study aims to link the nutrient contributions of Sanders Spring to the South Dry Sac River in the Valley Water Mill Watershed in Springfield, Missouri during baseflow periods. For each season, water samples are collected and analyzed for total nitrogen and total phosphorus. Discharge is also monitored at each sampling site using calibrated stage gages and one USGS station. Preliminary trends show seasonal variation of nutrient load at the Valley Water Mill Reservoir between the spring and the river which may indicate the role of sediment release and bacterial activity connected with algal blooms. This study will help us better understand how groundwater and surface water are connected in karst systems and how nutrient transport is influenced in Ozarks watersheds. Future work should include investigating nutrient loading during stormflow to more closely determine land use influences as well as the effect of bacteria on nutrient transport and storage.

23) Presentation Type: Poster

Title: DNA Metabarcoding for characterizing larval fish assemblages

Authors (Underline Presenter): Chelsea Titus¹, Jessica Hughes², Dave Herzog¹, Lori Eggert³, and Leah Berkman¹

Affiliations: ¹Missouri Department of Conservation, Resource Science Division

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Abstract (250 words maximum): Barcoding, or the identification of a species through genetic analysis, has been in use for over a decade and has been applied in forensics, surveys, and ecological studies of wildlife and fish. Recently, next generation sequencing (NGS) has provided a way to rapidly obtain DNA sequences from an entire community, known as metabarcoding. Although this technique has gained considerable attention in wildlife and fish management through its application to eDNA and the potential to survey a community from only a water or sediment sample, it can be applied to any assemblage for which species detection and identification with DNA can overcome difficulties in species ID by visual methods. However, many aspects of the technique must be tailored for a particular study. Species assemblages naturally vary spatially and the database of known DNA sequences may not contain representatives for all the taxa from a particular study area. Based on the ecological or management question of interest, analyses must be focused to maximize detection and minimize false presences. We designed and validated a metabarcoding approach specifically to identify species in larval fish assemblages from the Mississippi River. This process included mining available genetic data for Mississippi River species; identifying the best gene and corresponding primers to provide an appropriate level of sensitivity and taxonomic resolution; refining the DNA isolation procedure to exclude eDNA contaminants from the sample; establishing a bioinformatics pipeline to properly filter NGS data; and comparing to results from morphological identification.

24) Presentation Type: poster

Title: Bryophytes of Big Oak Tree State Park

Author: Nels J. Holmberg, John J. Atwood

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Abstract: Big Oak Tree State Park in southern Mississippi County contains remnants of a once dense bottomland forest that covered Missouri's southeastern-most counties from pre-settlement until the early 20th century. Within the park's bottomland forest are a shrub swamp community that occupies the margins, a man-made lake, a wet bottomland forest that surrounds the shrub swamp and extends to the lower western park boundary, and a wet-mesic bottomland forest that occupies the remaining eastern and northernmost sections of the park. The park's vascular plant flora contains more than 230 species, several of which have affinities with the Atlantic and Gulf Coastal Plains. A limited number of bryophytes have been reported from the park, but no systematic effort has been made to inventory the bryoflora. The purpose of this survey was to document the bryophyte diversity within Big Oak Tree State Park, and to establish a reference list of taxa for other floristic evaluations in the Mississippi Lowlands Natural Division. This bryophyte survey was conducted from 11 December 2015 to 27 March 2017. A total of 348 bryophyte collections were made during the survey, including 286 moss, 62 liverwort, and 1 hornwort collections. From these, 60 moss taxa, 9 liverwort taxa, and 1 hornwort were determined. Four species, *Gemmabryum klinggraeffii* (S1), *Pylaisiadelpha tenuirostris* (S2), *Rosulabryum flaccidum* (S2) and *Trematodon longicollis* (S2) are of conservation concern in Missouri and almost half of the bryophytes collected are newly documented county records for Mississippi County. *Fissidens hallianus* is newly documented for Missouri.

25) Presentation Type: Poster

Title: Lead concentrations in gravel bar vegetation in a contaminated river

Authors: [Jordan Heiman](#), Indigo Tran, Bob Pavlowsky, and La Toya Kissoon-Charles

Affiliation: Wetlands and Biology Education Research Group, Department of Biology, Missouri State University

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Abstract: River bar deposits generally represent a long-term source of pollution in mining-affected rivers as contaminants are gradually released back to the channel. Big River, located in the Old Lead Belt in southeast Missouri, was subject to large-scale contamination of channel sediments and floodplain soils due to over 200 years of lead mining. Plants growing on these contaminated sediments have the potential to be exposed to high levels of metals, and their ability to absorb contaminants from soil could play a vital role in metal mobility. Previous work involving Big River has focused on metal contamination, sediment geochemistry, river channel dynamics, and metal accumulation in organisms inhabiting the river. However, little research has been conducted on metals in the vegetation of this river system. Plants are the base of the food chain and are a means of chemical uptake from sediment. Investigating metal content of plants could indicate the amount of metal that has the potential to circulate in the ecosystem. We sampled leaves, bark, branches, and stems of sycamore (most abundant vegetation) trees on gravel bars upstream and downstream of the contamination point. These samples were dried, crushed, and analyzed for metal concentrations. We also conducted vegetation surveys to estimate vegetation density and biomass on each gravel bar. Results of this work will add to our understanding of the movement of metals in a contaminated system and the potential of these metals to become bioavailable and thus transported to various levels of the food chain.

26) Presentation type: poster

Title: The effects of prescribed burning on small mammal and ectoparasite communities in oak hickory forests

Authors: Tyler J Remick and Sean P Maher

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Abstract: Prescribed burning is known to effect small mammal communities and their parasites through habitat alteration and availability of resources. In this region the effects of prescribed burning focuses on grassland communities, including prairies and glades, but data is lacking on the effects in forested environments. To assess how forest small mammal communities and their parasites react to prescribed burning we established live trapping grids in both recently burned and unburned forest. Small mammals and ectoparasites were sampled for two consecutive summers. In addition, all trees within five meters of a trap station were identified and measured to assess effects of dominant habitat. Bray Curtis estimates of dissimilarity were used to compare small mammal and ectoparasite communities between trapping grids and years and an NMDS was used to assess similarity of vegetation between sites. Small mammal communities showed a strong similarity among years, and by forest treatment within a year. Ectoparasite communities were more dependent on small mammal species present and their abundance rather than treatment type. There was no clustering of vegetation based on forest treatment. Prescribed burning may lead to higher populations of generalist species, such as white footed mice (*Peromyscus leucopus*), but the year to year variation among populations has a greater effect. These mechanisms working in tandem can create fluctuations in small mammal communities subsequently effecting their ectoparasites. Understanding the mechanisms driving change in these communities can provide insight into possible disease spread, including various zoonoses, in this environment.

27) Presentation Type: Poster

Title: Relationship between atrazine distribution in wetland sediments and aquatic plant communities

Authors (Underline Presenter): Christine Cornish and La Toya Kissoon-Charles

Affiliation: Wetlands and Biology Education Research Group, Biology Department, Missouri State University

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Abstract (250 words maximum):

Scientists have long hypothesized that increased use of agrochemicals has resulted in increased transport of these compounds into wetlands. Terrestrially applied compounds are primarily transported into aquatic ecosystems through runoff, adsorption to sediment particles, and potential spray drift. In many cases, due to the persistence and mobility of these compounds, they can have negative effects on non-target species. Indirect application of herbicides through runoff and subsurface flow exposes aquatic plants to environmental pollutants that are potentially detrimental. Atrazine, a commonly used herbicide, has been detected in surface water, groundwater, soil, and sediment, and has been shown to negatively impact aquatic biota. Several studies have shown that atrazine has negative impacts on various aquatic organisms. However, few studies have directly focused on the negative effects on aquatic plants. We measured atrazine concentrations in wetland sediments, and investigated how these concentrations may be related to sediment characteristics and aquatic plant abundance and diversity in farm, golf, and conservation wetlands. Preliminary results indicate that all wetlands had similar atrazine concentrations. Comparably, atrazine found in surface sediment analyzed in Lake Michigan, Lake Superior, and Lake Huron were reported as 0.67 ng/g, 0.09 ng/g, and 0.15 ng/g, respectively. These data could be due to the persistence and mobility of atrazine in the environment. Previous research reported that pH and organic matter content can affect atrazine concentrations in aquatic ecosystems. However, in our study, atrazine did not correlate with sediment characteristics (organic matter content and particle size) or with water chemistry variables (pH and conductivity).

28) Presentation Type: Poster

Title: Factors Affecting Irrigation Water Use in Southwest Missouri

Authors (Underline Presenter): Shirley Hughes

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Abstract: Sustainable use of water resources in Southwest Missouri requires a better understanding of factors that influence groundwater use by crop producers in Southwest Missouri. The objective of this study is to assess the influence of weather patterns and edaphic factors on water used for agricultural irrigation. The Missouri Geological Survey's Water Resources Center provided groundwater withdrawal data from 14 high-use agricultural irrigation wells monitored between 2009 and 2016 as part of their Southwest Missouri Irrigation Project. Linear regression was used to assess the relationship of precipitation, temperature, drought monitor index, soil organic matter, water holding capacity, depth to limiting layer, and infiltration class with annual water use from each well. Precipitation volume, number of precipitation events, average maximum temperature, average minimum temperature, and the drought monitor index explained up to 25% of the variation in simple models of water use. Combined regression models explained up to 33% of the variation, with number of precipitation events the primary factor influencing irrigation water used.

29) Presentation Type: Poster

Title: Development of Predictive Egg Quality Indicators in Paddlefish: Egg Morphology, Tissue Culture, and Hormonal Indicators

Authors: Ryan Little, Ben Thomas, & Scott Lankford

Affiliation: Missouri Department of Conservation (MDC) & University of Central Missouri (UCM)

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Abstract: In the past, Blind Pony Fish Hatchery (BPH) has experienced inconsistent ovulation, fertility, and development rates in female paddlefish. Even if ovulation occurs, some paddlefish eggs stop developing prematurely; at times only half of the paddlefish spawned have resulted in usable fry. This inconsistency decreases the effective management of the put-grow-take paddlefish fishery, as well as drives up MDC's production costs. This project aims to develop a paddlefish broodstock ranking index for both egg quality and spawning readiness. The goal is to improve MDC's efficiency in selecting fish that will spawn in response to the hormonal injection and produce high-quality progeny that are more likely to survive the rearing process. Due to the limited knowledge available on paddlefish reproduction there are sparse techniques and spawning protocols available, and even fewer molecular assays. Because of this, the creation of a broodstock ranking index requires the development and optimization of the required scientific end points. The specific end points to be evaluated include spawning readiness indicators (i.e., egg polarity index [PI], egg bioassay, and oocyte actin A mRNA) and egg/progeny quality indicators (i.e., oocyte vitellogenin receptor mRNA, low density lipoprotein receptor mRNA, and plasma estradiol, testosterone, and cortisol concentrations). The data presented were developed from tissues collected during the spawning of the 2015, 2016, and 2017 year classes and include the optimization data required to validate the following endpoints: PI, egg bioassay, and the hormone concentrations of estradiol, testosterone, and cortisol.

30) Presentation Type: Poster

Title: Determining the Effect of Mission Design and Flight Pattern on the Quality and Accuracy of DEMs and Orthophotos Derived from UAV Imagery.

Authors: Daniel S. Hostens and Toby Dogwiler, Department of Geography, Geology, and Planning, Missouri State University, Springfield, MO, 65897.

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Abstract: Unmanned Aerial Vehicles (UAVs) are a cost-effective means of collecting imagery used to create high-resolution DEMs (Digital Elevation Models) and orthophotos of field sites. UAVs allow the rapid collection of images across field sites. Additionally, flight planning software allows the design of missions with control over flight pattern, camera angle, and image overlap. Ease of image acquisition and a lack of best practices in mission design lead most UAV projects to error on the side of obtaining large amounts of imagery to ensure a suitable final product. However, acquiring more imagery than necessary leads to considerable time and costs involved in processing the data. Understanding the minimum number of images and ideal flight plan(s) required to obtain a specific standard of DEM and Orthophoto quality is an important question. In 2017 imagery of the effects of the April 2017 flooding in the North Fork of the White River watershed was collected at seven different stream reach corridors ranging from 2.5 to 65 hectares. At each study site, four separate image acquisition missions were flown with varying flight patterns and camera angles. To georeference and rectify the imagery, sub-decimeter dGPS positions were collected at 5-10 visible targets distributed across each study site. The data were processed into DEMs and Orthophotos using various combinations of the imagery missions from each study site. The accuracy and resolutions of the resulting DEMs and Orthophotos are being compared to determine which combinations of methods yields the best results for the investment of time and effort.

31) Presentation Type: Poster

Title: An introduction to the electrified dozer trawl for sampling Silver Carp and fish communities in a lotic system

Authors: [Logan Holder](#), U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Jeremy Hammen, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Emily Pherigo, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Kevin Drews, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Jeff Finley, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office, Chris Brooke, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Jason Goeckler, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office; Wyatt Doyle, U.S. Fish & Wildlife Service, Columbia Fish & Wildlife Conservation Office

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Abstract: Notorious for being highly elusive, invasive Silver Carp are increasing in abundance throughout the Missouri River basin. The ability to sample multiple life stages of this fish species in a variety of habitats is very important for assessment and management. Swift currents and diverse habitat use limit a gear's ability to effectively and thoroughly sample a river or stream system. Recent interest has developed in modifying push trawls to capture a large size range of fish over diverse habitats in flowing systems. Combining traditional electrofishing with a rigid frame push net reduces the bias associated with each gear while combining the advantages of both techniques. An electrified push net, referred to as an electrified dozer trawl, captured Silver Carp at a rate twice that of traditional electrofishing while providing a similar length frequency. Sample sizes needed to assess a Silver Carp population could be decreased by nearly 1/3 when using an electrified dozer trawl compared to traditional electrofishing methods. Species richness was similar between techniques indicating potential to assess fish communities and other fish species populations using the electrified dozer trawl. The increased catch rates of Silver Carp, reduced bias in sampling different size classes and ability to sample the fish community indicates that the electrified dozer trawl is a flexible and robust tool for fisheries managers.

Keywords: Trawl, Carp, Gear

32) Presentation Type: Poster

Title: Quantifying relationships between oak performance and bottomland micro-topography in Missouri forests

Authors: Jen Weaver¹, Ben Knapp¹, John Kabrick², Megan Buchanan³

Affiliation: ¹School of Natural Resources, University of Missouri- Columbia; ²USDA Forest Service, Northern Research Station; ³Missouri Department of Conservation

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Abstract: Light is often considered the primary limiting factor for successful bottomland oak regeneration. However, micro-topography also plays an important role. In a bottomland ecosystem, an elevation change of a few centimeters can influence how water flows and accumulates, thus affecting soil characteristics important for seed germination and plant growth. Although it is generally understood that local landscape characteristics are associated with tree species composition in bottomlands, few studies have quantified these relationships. Now, with the advantage of accurate GPS and high-resolution LIDAR data, relationships between bottomland micro-topography and species occurrence can be quantified. A preliminary analysis of mid-story oaks at Deer Ridge Conservation Area showed a significant relationship between elevation and occurrence of oak species. In 2017, approximately 3600 oak seedlings were under-planted across a range of stand structural conditions and micro-topographic positions to examine the effects of light and micro-topography on seedling survival and growth. Similar data from studies at Duck Creek Conservation Area and Mingo National Wildlife Refuge are currently being analyzed. Combining release treatments with knowledge of site-specific micro-topography can potentially greatly improve regeneration success rates.

33) Presentation Type: Poster

Title: Leaving Harmful Algal Blooms in the Dark: Light Limitation of Algae in Missouri Reservoirs and What It Means for Management

Authors: Erin L. Petty, Daniel V. Obrecht, Rebecca L. North

Affiliation: University of Missouri

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Abstract: With harmful algal blooms increasing in frequency and intensity around the globe, interest is mounting to further understand the role of light and nutrients in managing suspended algae within freshwater reservoirs. In Missouri reservoirs, where summer algal biomass is often dominated by potential toxin-producing cyanobacteria, we are seeking to demonstrate how the interaction between limiting resources, light and nutrients, influences algal biomass and productivity. This study examines the range of light availability to -and the extent of light-deficiency within- algal communities in 65 Missouri reservoirs, ranging from oligotrophic (clear, low nutrients) to hypereutrophic (murky, excessive nutrients), during the summer of 2017. Light limitation is expected to exhibit a gradient reflecting land-use and lake productivity. For each reservoir, the availability of light was determined by calculating the mean daily light in the surface mixed layer. Those values were then compared to previously established indicator thresholds to assess light-deficiency. Data suggests a wide range of light availability in these reservoirs, with the majority indicating light-sufficiency. Approximately 17% of the reservoirs were found to be light-deficient at least once during the summer sampling period. When not subject to light-deficiency, algal growth is assumed to be under nutrient control. These assessments have critical implications within Midwestern watersheds, where the landscape tends to be dominated by agriculture. Results will be instrumental in developing and implementing regional management practices for controlling algal biomass and harmful bloom development.

34) Presentation Type: Poster

Title: Motor Boat Injury Rates and Patterns in Aquatic Turtle Communities

Authors: Ethan C. Hollender, Travis L. Anthony, and Day B. Ligon

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Abstract: Boat traffic has long been known to impact aquatic wildlife. However, the effects are unlikely to be evenly distributed among all the species that compose a community, with behaviors and habitat use influencing which species are most susceptible to the effects of boat traffic. We quantified boat traffic and measured the frequency of scarring from traumatic injury in 9 species of freshwater turtle across 5 sites in northeastern Oklahoma. Overall, injury rates increased significantly with increases in boat traffic. In one common species at all 5 study sites (*Graptemys ouachitensis*), 13.4% of individuals exhibited scarring, 1.5 times the average across species. Injury rates of other species ranged 0–8.8%. Missing hind limbs occurred 2.4 times more frequently than missing forelimbs, and the same pattern was seen in carapace damage, with scarring to the posterior half of the carapace 1.4 times more prevalent than the anterior half. Our findings likely underestimate the effects of boat traffic on aquatic species, as we were only able to sample those animals that survived boat encounters, and mortality remained unmeasured.

35) Presentation Type (Oral or Poster): Poster

Title: The Development of Quantitative PCR (qPCR) Targets for Use in a Spawning Readiness Index for Paddlefish (*Polyodon spathula*)

Authors: Laci Darling & Scott Lankford, PhD

Affiliation: Missouri Department of Conservation (MDC) & University of Central Missouri (UCM)

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Abstract: The Paddlefish (*Polyodon spathula*) is an ancient species native to North America whose fishery status and ecological impact demand its conservation. Population numbers have declined over the last decade, and due to this, the Missouri Department of Conservation (MDC) propagates this species annually at Blind Pony Hatchery (BPH). Recently, BPH has had inconsistent results between spawning seasons, resulting in loss of time and resources as well as a decrease in paddlefish numbers stocked. To lower this spawning variance and the resources required to spawn paddlefish in Missouri, a fertility index is being created to select which females to spawn and the order they should be spawned. To create this index, multiple parameters are being measured in each female to quantify reproductive status and egg-quality indicators. This part of the project is limited to the techniques involved in total RNA isolation, primer design, and quantitative PCR of paddlefish oocyte samples. Reproduction is complicated in all species due to hormone levels, gene expression, and environmental conditions; however, certain regulators are highly conserved among all species. This project focuses on three specific gene markers: vitellogenin receptor (VTGr), Low-Density Lipoprotein receptor (LDLr), and Inhibin Beta-A. VTGr and LDLr are indicators of egg quality, as they are associated with egg-nutrient acquisition, while Inhibin Beta-A indicates spawning readiness, as it has been found to increase right before ovulation in vertebrates. To perform this analysis, Elongation Factor 1-alpha (EF1a) was selected as a housekeeping gene due to its ubiquitous expression and constitutive function in vertebrate cells.

36) Presentation Type (Oral or Poster): Poster

Title: Professional Internship With The Missouri Department of Conservation- Fisheries: An Example of Applied Learning Partnership Between a Natural Resource Agency and An University.

Authors (Underline Presenter): Rachael Domann

Affiliation: Missouri Western State University

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Abstract: During summer 2017 I was honored to be selected for a Fisheries Management position with the Missouri Department of Conservation. I participated in numerous fish samplings of local lakes and ponds throughout Northwest Missouri and the Missouri River. Community samples were done regularly to allow the public the information of conditions of a particular body of water. I also participated in sampling that were for two different ongoing research studies that include predator fish and research on the method of electrofishing. During my time with fisheries I was able to learn about many other fisheries management responsibilities from my three mentors-the Northwest Regional office fisheries management biologists. This internship allowed me to learn a wealth of information through experiences about survey methods, fish population management practices, habitat plant control and implementation, assisting the public with their private pond management practices, zebra mussel management, hatcheries and stocking, and public water access' area management. I was also able to participate in outreach and education with fisheries assisting with fishing clinics for people of all ages. All these practices are done to assure the public has successful fishing experiences. The internship also allowed for me to learn about the responsibilities of all the departments of Missouri Department of Conservation. This internship not only allowed me the tools and education to better myself for future employment, it got me excited for my future in conservation and possibly fisheries management.

37) Presentation Type: Poster

Title: Neighborhood history on metal concentrations in roadside soils and street dusts, Springfield, Missouri

Authors: Kelly Rose, Dr. Robert T. Pavlowsky, Marc Owen

Affiliation: Missouri State University

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Abstract: Urban watersheds can be exposed to toxic concentrations of metals in stream sediments and soils due to releases from past chemical applications and industrial emissions. It is considered unsafe for human exposure if soils in residential areas contain >1,200 ppm lead (Pb). Soil Pb concentrations of 400 ppm within children's play areas pose a risk to the central nervous system and brain development in children. This study assesses Pb, and Zn, levels in roadside soils and road sediments in Springfield, Missouri. Sampling was stratified between two neighborhoods, an industrial area, and three streams. These areas were established at different times and had varying levels of traffic use. An XRF analyzer was used to measure heavy metals. Both road soil and sediment samples were collected from each urban site. There were 13 sites collected from an older neighborhood settled 100 years ago, 10 sites from a younger area settled in the 1980s, 7 sites in the industrial area, and 3 streams. The highest Pb concentrations were found in the older neighborhood. Maximum Pb concentrations in older areas exceeded 800 ppm for soil and 180 ppm for sediment. In comparison, maximum Pb concentrations in the younger neighborhood were >70 ppm for soil and >100 ppm for sediment. The third location exceeded 300 ppm for soil and >600 ppm in road side sediment. The highest concentration detected was 1,677 ppm Pb in a soil sample located along a commercial strip on the edge of the older neighborhood along a major road.

38) Presentation Type: Poster

Title: Applied Learning In Fisheries: An internship example of cooperative learning with Missouri Department of Conservation and Missouri Western State University

Authors (Underline Presenter): Tasha Hayden

Affiliation: Missouri Western State University

Presenter E-mail Address: thayden@missouriwestern.edu

Abstract: I worked with the Missouri Department of Conservation in the fisheries division in the summer of 2017. Over the summer I acquired a lot of skills and knowledge. I participated in population surveys using a technique called electrofishing. I also learned habitat management skills. I also helped with planting aquatic plants as well as spray aquatic and terrestrial invasive plants. My favorite part of the experience was the fishing clinics. I love working with kids and helping them learn. This was a dream job and I was very grateful to have had this applied learning experience.

39) Presentation Type: Poster

Title: Geospatial analysis of bank erosion for conservation planning, Lamar Lake Watershed, MO

Authors: Hannah R. Adams, Marc Owen, Ph.D. Robert T. Pavlowsky.

Affiliation: Missouri State University

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Abstract: Eutrophication is caused by excess nutrients and sediment that produce large algal blooms. In municipal water supplies large amounts of algae lead to chronic taste and odor problems often disrupting civilian use. Lamar Lake, located in SW Missouri, is experiencing this problem. In 1998 Lamar Lake was listed under section 303(d) of the federal Clean Water Act for algae pollutants caused by excess phosphorus. However, little is known about the role of bank erosion as a nonpoint pollution source in Lake Lamar. Historical aerial photos were used to digitize streams to analyze changes in channels for the following years: 1953, 1966, 1997, 2008, and 2016. Disturbances were classified using a conservative 4.1 meter buffer based on the 1997 aerial photos Max Point to Point Error. Riparian corridor condition was classified using the 2016 aerial imagery. The channel change and riparian classifications will be used to identify potential nonpoint sediment sources to the lake. Cross-sections at predetermined sites were extracted from LiDAR data. Results will be used plan a field study of channel stability and bank erosion to help identify conservation practices that are most beneficial to improve water quality.

40) Presentation Type: Poster

Title: Early Biological Observations of Curly-leaf Pondweed

Authors: Jessica Filla Mike Anderson and Brian Todd

Affiliation: Missouri Department of Conservation

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Abstract: Resource managers in Missouri document new invasive species every year. Understanding how those species interact and play a role in the environment is critical. *Potamogeton crispus*, otherwise known as curly-leaf pondweed, was found in Forest Lake, a water supply lake, in Kirksville, Missouri in 2016. Being that it is a water supply lake, there are policies that may not allow the city to use herbicides to eradicate or suppress this invasive species. Little is known about this aquatic plant in Missouri. Although our research is preliminary, we would like to present what we have learned. In September of 2017, we went to a lake that has been colonized for several years and measured turion density at numerous sites using an Ekman dredge. Turions are a seed-like structure that can accumulate quickly and appear to be the primary mode of reproduction. While taking observations, we counted up to 500 turions in a single square foot. We measured the early growth of these plants and are investigating the viability of turions. Along with that, we are trying to mimic how the turions respond to a drought or winter freeze. A single plant can apparently produce vast amounts of turions and each turion can produce four to six plants. There is much to learn about this plant, and data collection continues. This poster would let other resource managers know the risks and production potentials of this plant and help us gather information from other professionals who have previously dealt with curly-leaf pondweed.

41) Presentation Type: Poster

Title: Hornyhead Chub Nest Site Selection in the East Fork Black River

Authors: John Brant, Craig Paukert, Del Lobb

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Abstract: Alteration of available spawning habitat for native stream fishes may occur downstream of dams and thus identifying the habitat requires needed by these fish can help guide restoration efforts. The Hornyhead Chub and other species within the *Nocomis* genus are often referred to as “mound builders” because they use their mouths to make large piles of gravel for spawning. These spawning mounds may play an important role in stream fish communities because several other lithophilic spawning fishes use Hornyhead Chub nests. The Hornyhead Chub is known to have specific spawning substrate requirements, but little is known about what factor(s) limit spawning site selection. In this study, our object was to determine what habitat characteristics Hornyhead Chubs select for spawning in the East Fork Black River downstream of Lower Taum Sauk Dam. We conducted visual surveys in riffle/run complexes throughout a 6.3 km reach of the river in the spring and early summer of 2017, and measured habitat parameters at the mesohabitat and microhabitat scales where nests are present and absent. Discrete choice selection models were then used to determine the most important parameters for Hornyhead Chub spawning site selection. Study results for Hornyhead Chub spawning site selection in the East Fork Black River will help us better understand the downstream effects of flow, water quality, and substrate characteristics caused by large dams.

42) Presentation Type (Oral or Poster): Poster

Title: Monarch butterfly use and survival of planted milkweed in restored prairie in central Missouri

Authors (Underline Presenter): Anna M. Hesse, Leah M. Piazza, Wesley A. Hanks, Eric W. Kurzejeski, and Larry D. Vangilder

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Abstract (250 words maximum):

The international decline in Monarch butterfly populations is widely publicized yet poorly understood. The Missouri state plan lists establishment of milkweed and availability of seed sources as major factors limiting Monarch populations and habitat restoration. To address these needs, in spring 2017, we planted 6,400 milkweed plants on 32 one-acre plots within restored prairie on Prairie Fork Conservation Area (PFCA). All plots were mowed and treated with grass herbicide. Additionally, half of the plots were disked prior to planting. We examined the effect of planting bare-root stock and nursery grown plugs on milkweed survival. Survival of bare-root stock, at one month post-planting, was 81% while survival of plugs was 46%. Plugs had higher survival on disked plots (55%) than on plots that were mowed and treated with grass herbicide (37%). We also examined the relationship between milkweed plant height and vegetation density surrounding individual plants with and without the presence of Monarch eggs or larvae. To determine the presence of eggs and larvae, we surveyed 20 randomly selected plants per plot, each week, between July 15 and October 5. For each plant, we measured plant height, number of eggs or larvae present, and visual obstruction readings (VOR) using a Robel Pole. Our hypothesis is that Monarchs deposit eggs more frequently on taller plants with lower surrounding vegetation density.

43) Presentation type: Poster

Title: Home range dynamics and habitat selection of the eastern spotted skunk in the Ozarks

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Abstract: The eastern spotted skunk (*Spilogale putorius*) is a small, once common mesopredator and member of the Mephitidae family. Beginning in the 1940s, it declined across its range, which includes the Ozark Ecoregion. Reasons for the range-wide decline are still unknown, but currently the species is considered threatened, rare, or of conservation concern by many states within its range and one subspecies has been petitioned for listing under the U.S. Endangered Species Act. Despite several new studies aiming to understand the basic ecology of the species, few efforts have focused in the Ozarks. Thus, we developed a project to assess home range dynamics and habitat selection of the eastern spotted skunk in north-central Arkansas. Beginning in March 2017 and continuing presently, we deployed camera traps across a large-scale grid in Ozark National Forest and Gene Rush Wildlife Management Area to assess landscape-level habitat selection. We confirmed the presence of eastern spotted skunks in the Arkansas Ozarks at three camera trap sites. We will begin live-trapping and radio-tagging skunks in winter 2017-2018 to determine home range dynamics and resource selection. This project will shed light on the effects of common habitat management actions like prescribed burns and timber harvest on movement patterns of eastern spotted skunks. It will provide guiding information for eastern spotted skunk managers across the Ozark region.

44) Presentation Type: Poster

Title: Range extension and habitat characteristics associated with occurrence of grass shrimp (Crustacea: Decapoda) in wadeable streams in Missouri.

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Abstract: We found specimens of grass shrimp (*Palaeomonetes kadiakensis*) in aquatic macroinvertebrate community samples collected from reaches of wadeable streams in Missouri as part of the Resource Assessment and Monitoring Program. Our records extend the range for *P. kadiakensis* in Missouri provided in the IUCN Red List and USGS-NAS continental range maps depicted for this species on the internet into northwestern drainages of the Osage River Basin and northwestern drainages of the Grand River Basin in Missouri. The range extension and habitat characteristics found associated with occurrence of *P. kadiakensis* in Missouri are presented.

45) Presentation Type: Poster

Title: Measurement of Nutrients, Antibiotics, and Enzyme Activities in the Wetlands of the Moreau River

Author: Doggett, W., Eivazi, F., and M. Dolan-Timpe

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Abstract: Research has indicated that the use of animal manure as fertilizer is a significant point source of pollution to the environment. Antibiotics are commonly used drugs in animal production. These drugs mixed in feed rations to be used as growth promoter and therapeutic agents. The manure from treated animals normally contains antibiotic metabolites and some non-metabolized antibiotics. By application of this manure to the agricultural lands as fertilizer, the antibiotics are introduced to the soil. Along with antibiotics, many other elements such as excess phosphorus and nitrogen are introduced to the land with repeated manure applications. Through surface runoff, the antibiotics, nitrogen, and phosphorus are transported to the wetlands and find their way to the rivers causing pollution of water resources. Excess nitrogen and phosphorus in water bodies is the cause of eutrophication; and contamination by antibiotics could adversely affect the microbial community and enzymatic activities. The sensitivity of enzymes to the environmental pollution, the ease of assay, and their role in soil biological functions makes them useful tool as indicator of soil and water quality. The objectives of this study are: 1) to measure the activities of β -Glucosidase, Arylsulfatase, Acid Phosphatase, β -Glucosaminidase, Phenol Oxidase, and Peroxidase in the soil/sediments of Moreau River wetlands; 2) to measure the concentration of nitrogen, phosphorus, and antibiotics in water samples taken from Moreau River. Our findings will be presented and discussed.

46) Presentation Type: Poster

Title: Carnivore Communities Structure and Activity Patterns in a Restored Tall Grass Prairie

Author: Jena Staggs, Rachel Williams, Dr. Gompper

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Abstract: Mammalian carnivores are known to mediate important top-down effects on ecosystem structure and function. In remnant grassland ecosystems, how the carnivore community is influenced by habitat restoration is poorly understood. We have undertaken a study at Prairie Forks Conservation Area in central Missouri to discern the use of restored prairie, focusing on differential habitat use and activity patterns. PFCA contains grassland habitats of varying age as well as some interspersed forest habitat. A camera trapping survey commenced in late 2016 at PFCA, with the objectives of (1) assessing whether carnivore species vary in their use of different age habitats, and (2) where this use is reflected in their activity patterns when in these same habitats. Camera traps were randomly placed in different habitat types and photographic images (> 100,000 to date) identified to species. To date we have identified the presence of 9 species (all 9 in grassland and 5 also found in forested habitats). Asymptotic curve analyses suggest most species have now been identified. Analyses of the relative likelihood of detecting these species in grassland and forested habitats is ongoing, as is analysis of activity patterns of each species.

47) Presentation Type: Poster

Title: Investigating Perceptions of Wildlife and Vegetation in Urban Greenspaces

Authors (Underline Presenter): Andrew Mallinak, Charles Nilon, Robert Pierce, Sebastian Moreno

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Abstract: There is a growing level of empirical evidence supporting the contribution of urban greenspaces to wildlife and plant diversity within urban environments. In turn, these spaces serve as essential sources of nearby nature contact for local residents. Cities can work with residents to take unused vacant lands with spontaneous vegetation and transform them into resident-accepted spaces that can serve as wildlife habitat while benefiting local residents socially, economically, and psychologically. However, in order for these nature spaces to be positively valued, used, and cared for by local residents, planners must first understand how to design and manage them. This study is conducting focus groups and semi-structured interviews with residents, planners, and local organizations involved in two St. Louis, Missouri neighborhoods with a high percentage of vacant land. Using these methods, we seek to understand how wildlife and vegetation within these vacant lots affect people's perceptions and management preferences of these urban greenspaces, with the ultimate goal being maximized benefits for wildlife and people.

48) Presentation Type: Poster

Title: Ava/Cassville/Willow Springs Ranger District - Glade Top Trail Interpretive Tour/NatureWatch Viewing Site/Agents of Discovery Mobile Game

Authors: [Antoinette Sitting Up Perez](#) and Darla Rein

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Abstract: Glade Top Trail Interpretive Tour (GTT) is a driving tour that encourages visitors to stop at 10 sites along the trail, which include Haden Park, Smoke Tree Scene, Arkansas View, Watershed Divide, Caney, McClurg Glade, Panorama, Big Creek Basin, Willie Lee, and Wolf Junction. Each stop has a QR code that can be scanned using a mobile device to bring up information for that particular site. Visitors will enjoy all the beauty the Ozarks have to offer and learn about the Mark Twain National Forest and its history. The GTT is a National Forest Scenic Byway.

Glade Top Trail is a Forest Service *Top NatureWatch Viewing Site*. An ArcGIS based story map allows visitors to virtually tour seven sites along Glade Top Trail. Photos of each area depict wildlife and wildflowers that can be viewed throughout the year. Take a peek at the story map and get outside to view this incredible gem in the Missouri Ozarks!

Agents of Discovery is a mobile game visitors of all ages can play at Caney Picnic Area. This application can be downloaded for free to mobile devices. The game is designed to inspire visitors to get outside, move, and engage their natural surroundings. The Glade Top Trail – Caney Picnic Area Mission Site has 10 stops where an animated character, *Agent District Ranger Roadrunner*, escorts players to challenges; correct answers receive USBees as a reward. Once at the site, a mobile device with GPS capability is all that is needed to begin the adventure.

49) Presentation type: Poster

Title: Validation of Annulus Formation in Rock Bass Otoliths

Authors: Kylie Sellers, Edward Sterling, Robert Snyder, and Quinton Phelps

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Abstract: In this study, five Ozark streams were sampled in southern Missouri between April and October 2016 and 2017. A representative sample of Rock Bass (*Ambloplites spp.*) were sampled via angling and aged by use of scales and sagittal otoliths. Age bias plots determined that age estimates from scales were less precise than age estimates from otoliths. Using the age estimates derived from the otoliths, estimates of recruitment, growth and mortality were formulated for each stream. To determine the validity of using otoliths as ageing structures, marginal increment analysis was performed with the sagittal otoliths from each Rock Bass collected. This analysis was used to determine the efficacy of using Rock Bass otoliths as a reliable ageing structure.

50) PRESENTATION TYPE: Poster

TITLE: Herpetofauna surveys on Missouri Ozark glades: Preliminary results

AUTHORS: Mark S. Mills, Chris D. Watson, Bethany Bolander, Jessie Green

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ABSTRACT: Glades are open, rocky habitats surrounded by forest in the uplands of the Ozarks of Missouri and Arkansas. In addition to being rocky, glades are characterized by having shallow soils and often face south or southwest, making them warm and dry. In Missouri, glades serve as “islands” of drier prairie or desert habitat in an area dominated by oak-hickory forest, making them important habitats for a variety of what are often thought of as more western species. Glade indicative species include a wide variety of vegetation, invertebrates, birds, and central to this presentation, amphibians and reptiles. We are part of a team that is surveying glades located on Missouri Department of Conservation land throughout the Ozarks of Missouri. We surveyed 30 glades in our first year (2016-2017), documenting a wide variety of species such as flat headed snakes (*Tantilla gracilis*) and pickerel frogs (*Rana palustris*). We will attempt to correlate species richness and abundance, particularly of glade indicative species such as the collared lizard (*Crotaphytus collaris*) and the variable ground snake (*Sonora semiannulata semiannulata*), with various attributes of these glade sites, including dominant rock type, fire management history, and location. The results of this first season and subsequent seasons of this ongoing study will be used to help the Missouri Department of Conservation monitor the overall health of glades throughout the Ozarks and develop better informed management plans of these unique and sensitive habitats.

51) PRESENTATION TYPE: Poster

Title: 2017 Missouri Pollution and Fish Kill Incidents

Author: Morgann Clinton, Water Quality Biologist, MDC

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Abstract: Fish kills are characterized by the sudden death of large numbers of aquatic animals in a clearly distinct area. Fish kills associated with pollution can have long-lasting effects on aquatic ecosystems and are of great concern to the public who recreate on the water and depend on surface water for drinking. The Missouri Department of Conservation (MDC) conducts fish kill investigations under the authority of the *Wildlife Code of Missouri* (Section 252.210, RSMo) and has maintained a Fish Kill and Pollution Program since the early 1940's. MDC is the lead agency in Missouri for response and investigation of fish kill incidents. The program is a partnership among multiple resource agencies; however, the Missouri Department of Natural Resources (DNR) is the primary partner. The overarching goals of the program are to protect aquatic resources and to maintain high-quality fishing and recreational opportunities. We work towards these goals by 1) conducting fish kill and water pollution investigations so pollution abatement and mitigation is achieved and 2) increasing awareness of water pollution and mortality in aquatic life through reporting of incidents. This poster will give a summary of fish kills occurring during 2017 and will provide an analysis of long-term trends in causes of fish kill events.

52) Presentation Type: Poster

Title: Aquatic macroinvertebrate community structure and colonization informs collaborative substrate augmentation efforts on an impounded Ozark stream.

Authors: Seth Lanning, William Mabee, Matt Combes

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Abstract: Lower Taum Sauk Reservoir affects stream resources in Missouri's southeastern Ozarks by disrupting the hydrologic, geomorphic, water quality, and biologic processes that shape river habitats and aquatic community structure in the East Fork Black River. Long-term monitoring by The Missouri Department of Natural Resources found that the macroinvertebrate community downstream of Taum Sauk Dam was impaired, and analysis of particle size distribution by the Missouri Department of Conservation identified interrupted transport of sand and gravel sized sediments as a potential contributing factor. We placed samplers containing substrate particles of the sizes of interest in a series of riffles downstream of the dam and left them to be colonized for five weeks. We then compared the macroinvertebrate community of the samplers, and the macroinvertebrate community of the ambient substrate, at differing distances from the dam. We concluded that colonization by otherwise absent invertebrate taxa could occur at sites near the dam if sediments of the appropriate size were present. These results were then used in a collaborative, adaptive management effort with Ameren Missouri to guide the location and particle size distribution of a 24 cubic foot substrate addition to augment existing substrate.

Keywords: Substrate, Macroinvertebrates, Hydrology, Geomorphology, Ecology, Impoundments