Restoring the fish community of Euclid Creek in Acacia Reservation.

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Euclid Creek, a direct tributary of Lake Erie, encompasses a heavily urbanized watershed in northeastern Cuyahoga County and southwestern Lake County, Ohio. No segments of the creek are currently in full attainment of Ohio's warmwater habitat standards, due to poor in-stream habitat and biological communities dominated by pollution-tolerant species. Cleveland Metroparks restored 950 linear feet of Euclid Creek in Acacia Reservation, the site of a former golf course, in Lyndhurst, Ohio. Pre- (2015) and post-restoration (2017, 2019) monitoring of stream habitat (QHEI) and fish community (IBI) were conducted, documenting marked improvement in QHEI scores and total number of fish present. Due to multiple downstream barriers to migration, only 3 species of fish continue to be present at the restoration site despite improvements in stream habitat. Cleveland Metroparks began a pilot fish translocation project in 2019, collecting a greater diversity of native species from sites in lower Euclid Creek and releasing them at the restoration site, in expectation that the improved habitat will allow establishment of self-sustaining populations, improving the biological diversity of the creek and raising IBI scores.

A Comparison of Aquaculture Production Methods for Optimizing Production of Fingerling Yellow Perch (*Perca flavescens*)

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Yellow Perch aquaculture has increased since the 1980s to reverse declines in wild populations and meet increased demands by anglers. Over the past 41 years, staff at the St. Marys State Fish Hatchery (SFH) in western Ohio used different methods to obtain Yellow Perch eggs, support embryonic development and hatch eggs, and rear the fry in ponds to the fingerling stage for stocking. We used hatchery records from 1977 through 2017 to statistically compare production outcomes among various rearing methods including: (1) natural vs manual spawning, (2) embryo hatching methods, (3) organic vs inorganic pond fertilization, and (4) fry residence time in ponds before harvest. We found that the most reliable production of Yellow Perch fingerlings consisted of placing hormone-induced females in tanks with males, hatching embryos in Heath trays, and stocking fry in ponds fertilized using liquid inorganic fertilizers. While our study is retrospective, and thus precludes assigning causality to any observed improvements in yield with method changes, adopting these methods at St. Marys SFH has increased harvest density of fingerlings produced from 13 ± 4 to 53 ± 6 fish·m^{-2} (mean ± SE).

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H2Ohio: Nutrient Reduction and Wetland Restoration at the Ohio Department of Natural Resources, a Brief Review

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H2Ohio is Governor Mike DeWine’s comprehensive, data-driven water quality plan to reduce harmful algal blooms, improve wastewater infrastructure, and prevent lead contamination. To accomplish this task, the Ohio General Assembly invested $172 million in the plan in July 2019, and since then, H2Ohio experts have been developing strategies for long-term, cost-effective, and permanent water quality solutions. Funding has been allocated to three different state agencies: Ohio Department of Agriculture, Ohio Environmental Protection Agency and the Ohio Department of Natural Resources. This presentation provides a brief overview of the wetland restoration role of the Ohio Department of Natural Resources and what has been accomplished.

Evolutionary History, Ecology, and Conservation of Tonguetied Minnow (*Exoglossum laurae*)

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Tonguetied minnow (*Exoglossum laurae*) is a rare species that maintains a fragmented distribution across four watersheds of the eastern and Midwestern United States. This presentation will summarize 10 years of research on tonguetied minnow, with emphasis on the Great Miami River population. Phylogenetic studies have determined that tonguetied minnow is comprised of two evolutionary lineages whose origins lie within the ancient Pittsburgh and Teays Rivers, two principal palaeodrainages of central and eastern North America. Molecular studies have revealed that population genetic diversity within the Great Miami River is very low. Species distribution models have shown that the Great Miami River population is confined to the Mad River as a consequence of low water temperature and high stream gradient. Additional models for brown trout (*Salmo trutta*) annually stocked for sport fishing in the Mad River support the premise that the geographic distribution of this non-native is a consequence of low water temperature and rocky substrate. Finally, DNA barcoding using next-generation sequencing has found signatures of tonguetied minnow in an appreciable number of gut contents collected from Mad River brown trout. Conservation and management recommendations will be given for tonguetied minnow based on a synthesis of these results.

Effects of light pollution on Bluegill (*Lepomis macrochirus*) feeding behavior

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Artificial light at night (ALAN) is one of the most pervasive and rapidly expanding sources of anthropogenic pollution. As important reservoirs of biodiversity, aquatic ecosystems may be especially vulnerable to the effects of ALAN. However, research on mechanisms of response to ALAN by aquatic species remains sparse. Our research investigates the extent to which ALAN influences the nocturnal feeding efficiency of Bluegill (*Lepomis macrochirus*). Juvenile Bluegill were randomly assigned to five different nighttime lighting treatments and held under these conditions for six weeks. We conducted weekly nighttime feeding trials to assess the foraging efficiency of the fish. As intermediate predators, Bluegill are expected to face a tradeoff between the reward of increased foraging opportunities and the risk of increased predation under ALAN. Therefore, we expect Bluegill foraging efficiency to increase as ALAN increases from low to moderate intensity and less time is required to locate prey. However, at higher ALAN intensities, we expect Bluegill to spend more time hiding and less time foraging due to an increased sense of vulnerability. Analyses are ongoing to test these predictions. Such a shift in Bluegill behavior would have implications for their prey, as well as for their larger-bodied predators.

Zooplankton Community Dynamics in the Central Basin of Lake Erie

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The Lower Trophic Level Assessment Program was established to monitor and assess factors influencing Lake Erie fisheries. Monitoring the zooplankton community gives insight into lake trophic status based on the types of organisms present and in what ratio. The main objective for the central basin of Lake Erie is to maintain mesotrophic conditions that favor percids. Zooplankton samples were collected every two weeks from May to September at 18 stations, and our dataset includes samples from 2000-2011. This project focuses on zooplankton community trends from two sites in the central basin at 5 m and 14 m deep. Rotifers, dreissenid veligers, and copepod nauplii had the highest yearly and monthly densities and were found in over 95% of the samples. Veligers dominated the yearly biomass in 2000, 2005-2008, and 2010-2011, rotifers in 2001, cladocerans in 2002 and 2003, and calanoid copepods in 2009. Yearly density and biomass were higher at the 14 m site most years. The ratio of calanoid copepods to cladocerans plus cyclopoid copepods at our sites indicated more eutrophic conditions compared to historical offshore sites, however they are a good indicator of a zooplankton community in the transition between the eutrophic western basin and mesotrophic central basin.

Does physical habitat restoration in urban streams of the Ridge and Valley ecoregion improve biotic integrity?

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The business of stream restoration is a billion dollar industry today. Funds are used to correct anthropogenic damage to hydrologic and geomorphic functionality and to allow natural processes to return. The goal of our study was to determine if physical habitat restoration has improved biotic integrity of fish and benthic macroinvertebrate assemblages in urban streams draining the Ridge and Valley Ecoregion of Tennessee. Twelve sites were selected, whereby three were considered physically restored for at least seven years, three were impaired reaches from varied levels of urbanization, and three streams were considered ecoregion reference streams to serve as a baseline for healthy benthic integrity. Invertebrates were collected bimonthly along with water quality and habitat quality data, and fishes were sampled semi-annually. To assess ecosystem health, index of biotic integrity (IBI) metrics and scores were calculated for each sample for fish and benthic macroinvertebrates, respectively, following Tennessee Valley Authority and Tennessee Department of Environment and Conservation protocols. Restored stream reaches showed 30% improvement over impaired stream reaches for benthic macroinvertebrate IBI scores and metrics, but fish IBI scores and metrics showed no improvement. Presumably, impoundments from the Tennessee River system prevent fish species from dispersing to these headwater reaches.

Impacts of a native fish reintroduction on resident fish assemblages

Brian Bush, Brian Zimmerman, and S. Mažeika P. Sullivan

Native fish reintroduction can be a valuable conservation tool used to curb declines in biodiversity. Previous native fish reintroduction projects have focused on monitoring population responses of the target species, yet potential changes in the resident fish assemblages have received less attention. The reintroduction of the Bluebreast Darer (*Etheostoma camurum*) to the Upper Licking River basin in Ohio will be used as a model to understand how reintroduction may alter resident fish assemblages. This reintroduction began in 2016, with one additional year of stocking in 2017, and yearly follow-up surveys through 2019. Fish community, water-chemistry, and geomorphic measurements were also performed at the reintroduction sites. Linear mixed models will be used to explore those factors influencing changes in the resident fish community over the course of the multi-year reintroduction project. Preliminary results suggest a positive relationship between relative abundance of Bluebreast and community evenness, as well as a strong correlation between larger substrate and relative abundance of Bluebreast and community evenness. This research will help to better understand how reintroductions may impact aquatic community architecture and inform future reintroduction efforts.

Collaborative brook trout monitoring with environmental DNA sampling

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Brook trout (*Salvelinus fontinalis*) are a recreationally important species, a regional icon, and indicator of water quality; however, populations have been eliminated or greatly reduced throughout their native range in the eastern United States. Lotic populations of brook trout are currently restricted to small, cold, headwater streams in the central and southern parts of the native range. Traditional sampling techniques are hindered by topography and access to private lands. Therefore, improved inventory and monitoring are critical for understanding the distribution, as well as tracking the successes and failures of conservation and restoration efforts. An alternative to traditional sampling techniques is the advent of environmental DNA (eDNA) technology, which allows biologist to rapidly and inexpensively determine the distribution of species over broad geographic areas, as well as monitoring sites at regular intervals to detect changes in species distributions. In 2019 and 2020, we targeted potentially extirpated and unsampled headwater streams in West Virginia and Virginia to identify presence or confirm absence. Based on early results of 150 samples, we identified novel brook trout habitat as well as areas that may represent marginal populations, where traditional sampling methods are ineffective when population density is low.

Lightning Talks

Returning Large Woody Debris to Urban Streams: Home Renovation for Urban Fish of Cooper Creek, Cincinnati, OH.

Connor McCombs[1], Adam Lehmann[2], Katherine Curtis[1], Megan Urbanic[1], Michael Booth[1]

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Within many urbanized watersheds, increased impervious surface cover and surface water runoff results in erosive flows and a decrease in base flow. For a stream that already contains a relatively low flow, a continuation of stream channel widening due to erosion and further lowering of base flow has the potential to reduce available fish habitat and interconnectivity between habitat. This is no exception for Cooper Creek, an urbanized headwater stream in Cincinnati. Under base flow conditions, pools hold the majority of the fish in the creek, and are hydrologically disconnected and few and far between. Habitat is limited in Cooper Creek, with only 12 pools in the first 510m of Cooper Creek and much of the stream bed between the pools intermittent. Hamilton County Soil and Water plans to augment the large woody debris (LWD) to improve habitat and water quality. LWD has been known to increase base flow by creating more pools and low flow channels, and by increasing hyporheic exchange by slowing the water down. This has the potential to create more pool habitats for fish and allow for more interconnectivity between pools if average base flow increases. Our project assessed the fish community annually from 2018-2019 via electrofishing and passive integrated transponder telemetry and additionally quantified woody debris currently present in Cooper Creek. We measured LWD abundance and distribution and used this data to calculate LWD indexes. We scored LWD based on zone (locations within flood prone channel), size, orientation and security. Annual electrofishing survey found the fish community (primarily Creek Chub *Semotilus atromaculatus* and Central Stonerollers *Campostoma anomalum*) are concentrated within pools. Compared to two non-urbanized streams in Northern Ohio, Cooper Creek's LWD abundance appears to be half that of a non-urbanized stream. Our data provides baseline information that will inform the planned LWD installation and provide reference for changes to the stream structure and fish community following installation.

Hydrology and Fish Movement in Small Urban Streams

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Urban stream systems are characterized by a distinct flow regime impacted by the overwhelming presence of impervious surfaces, creating a hydrograph dominated by short, intense flow events. Although the fish communities in these systems are typically low in diversity and characterized by pioneer species, the effects of flashy hydrology on fish movement in small urban streams is largely unexamined. To understand how fish are impacted by flow events, we tracked the movements of individual fish using Passive Integrated Transponder (PIT) tags and a portable tag reader in Cooper Creek system (a headwater tributary of Mill Creek in Cincinnati) in relation to stream discharge. Due to the magnitude of the flows in this stream, we hypothesized that 1) fish are displaced by flow events or 2) fish movement will increase in response to flow events, and that this increased movement will be upstream in nature. We scanned the stream for PIT tagged fish 29 times over a 9-month period from 3/2019 to 11/2019 using a portable tag reader. Hydrology data was provided by the Hamilton County Soil and Water Conservation District. The stream system is largely populated by Creek Chub (*Semotilus atromaculatus*) and Central Stonerollers (*Campostoma anomalum*), and preliminary analyses suggest that relatively large movements (>200m) do occur during high flow events, but many individuals are found in the same pools after high flow events. As such, it seems that flows enable fish movement such as recolonization without washing the population away and so may be an important part of maintaining an urban stream ecosystem.

Recruitment dynamics of Ohio River Sauger populations

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Throughout North America, variable recruitment of *Sander* spp. causes fluctuations in populations affecting the quality of popular, harvest-oriented *Sander* spp. fisheries. Fisheries managers often seek to index *Sander* spp. age-0 abundance to forecast future population levels and determine the mechanisms responsible for variability in survival during the first year. We used data from fall, night electrofishing surveys of Ohio River dam tailwaters during 2005–2019 to (1) determine whether Sauger *Sander canadensis* age-0 abundance relates to abundance of later cohorts (i.e., does age-0 abundance forecast future recruitment to the fishery), (2) quantify spatial synchrony in Sauger age-0 abundance among Ohio River tailwaters, and (3) determine whether spawning stock abundance, spring discharge, or spring temperature explain variation in Ohio River Sauger age-0 abundance. We found that Sauger age-0 abundance had a significant, positive relationship with age-2 abundance of the same cohort, indicating that survival during early life stages controls recruitment. Sauger age-0 abundance positively correlated among Ohio River tailwaters but the strength of the correlation was not related to spatial distance among tailwaters, providing evidence that factors operating on broad, river-wide spatial scales drive variation in age-0 abundance. Finally, we found no significant relationships between Sauger age-0 abundance with spawning stock abundance, spring discharge, and spring temperature in preliminary analyses. Long time-series data (> 20 years) are often necessary to understand *Sander* spp. recruitment dynamics. Therefore, commitment to continued standard assessments of Ohio River Sauger populations will allow researchers to identify the factors driving Sauger recruitment and ultimately, fishery quality.