

ABSTRACTS



2019 Meeting

North Carolina Chapter of the American Fisheries Society

&

North Carolina Freshwater Mollusk Workgroup

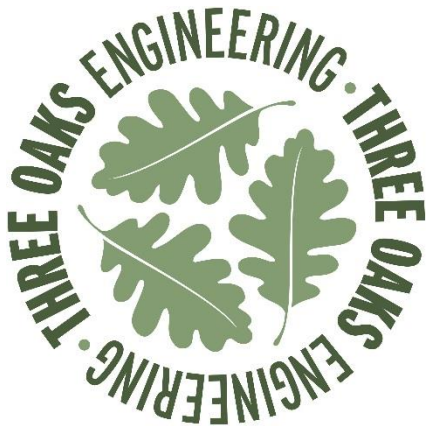
Tuesday, February 19th – Thursday, February 21st, 2019

The Historic Brookstown Inn

200 Brookstown Ave

Winston-Salem, NC

We would like to thank our sponsors of the 30th
annual meeting of the North Carolina Chapter
of the American Fisheries Society



Variation in Pollutant-Removal Ecosystem Services of Toxic Heavy Metals by Freshwater Mussels

Jennifer M. Archambault*, Meredith L. Shehdan, Clayton L. Lynch, Sean B. Buczek, and W. Gregory Cope
*Presenting

Department of Applied Ecology, North Carolina State University, Raleigh, NC

The filter-feeding action of native freshwater mussels serves several recognized ecological functions, and it acts as an ecosystem service to humans by sequestering harmful pollutants from drinking water and recreation resources. Building on our research of quantifying the pollutant-removal ecosystem services of freshwater mussels at the population level, we conducted three 28-day experiments with nickel (Ni) and cadmium (Cd) – two toxic heavy metals of environmental and human health concern – to determine how this service may fluctuate with differing environmental conditions. We exposed Eastern Elliptio (*Elliptio complanata*) to five concentrations of nickel, cadmium, or nickel + cadmium, that represented a range of conditions measured in North American surface waters (0 – 100 µg/L for Ni; 0 – 2 µg/L for Cd), encompassed the US EPA ambient water quality chronic criteria for protection of aquatic life, and encompassed US EPA drinking water standards. We sampled three of nine replicate mussels in each treatment on days 7, 14, and 28 to measure tissue metal concentrations over time, daily samples of excreta (composited weekly by replicate) to measure biodeposition of metals, and weekly test water samples (replicate composites) to verify exposure concentrations and measure the proportion of metals removed by mussels. We will present on preliminary results from this work. Our findings attempt to estimate environmental partitioning of pollutants by mussels; they may help to estimate variation in mussel pollutant removal in the wild (e.g., changes with varying environmental pollution), and will aid in contextualizing the role of native freshwater mussels in providing ecosystem service benefits to people.

Type: Lightning Talk

Student or a Professional? Student

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***In Situ* Evaluation of Freshwater Mussel Sensitivity to Prescribed Algaecide Applications
in a North Carolina Piedmont Reservoir**

Sean B. Buczek*¹, W. Gregory Cope¹, Meredith Shehdan¹, West M. Bishop², Robert J. Richardson³,
JoAnn M. Burkholder¹, Thomas J. Kwak⁴, John Jessup⁵, Tyler R. Black⁶
*Presenting

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⁶North Carolina Wildlife Resources Commission, Mebane, NC

Management strategies for the treatment of noxious algae or cyanobacteria often include the use of aquatic algaecides. Copper-based formulations are widely applied to control algal blooms and even mitigate the potentially hazardous impacts of toxin producing cyanobacteria. However, based on our previous laboratory toxicity tests, even when used according to label recommendations, such pesticides may have unintended lethal impacts to non-target organisms, such as native freshwater mussels. Therefore, to better inform future risk assessment and management decisions on the use of chemical remediation and to gain a better understating of the ecological interactions influencing non-target toxicity, we conducted an in situ field-based study on the effects of prescribed algaecide treatments of Captain[®] XTR and Reward[®] for the control of Giant Lyngbya (*Lyngbya wollei*) in Lake Gaston. Survival of caged adult Tidewater Mucket (*Leptodea ochracea*) was determined before and 96-h post algaecide application (n=4) at 30-d intervals from July through October 2018. The study included two treatment sites (coves) with different target copper concentrations; one at 0.25 mg/L and one at 0.5 mg/L, as well as an untreated reference (control) site. Percent survival in the treatment sites and reference site at the 96-h time point was 68, 72, and 100, respectively. Survival after three consecutive applications was only significantly different between the 0.25 mg/L treatment site and the reference site (p=0.003). However, the mortality risk of caged mussels in the two treatment sites was on average 3.3 (0.5 mg/L) and 5.1 (0.25 mg/L) times greater than those in the reference site. Our results highlight the complex chemical interactions of algaecides within the environment and their influence on mussel toxicity. This information can be used to help develop more adaptive management strategies that are less hazardous to non-target organisms without reducing overall algaecide efficacy.

Type: Full Presentation

Student or a Professional? Professional

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Filling the Gaps: Surveying for Two Mussel Species Under Federal Listing Review

Katharine DeVilbiss* and Brena Jones
*Presenting

North Carolina Wildlife Resources Commission, Aquatic Wildlife Diversity Program, Creedmoor, NC

The Atlantic Pigtoe (*Fusconaia masoni*) and Brook Floater (*Alasmidonta varicosa*) are state endangered freshwater mussel species in North Carolina. Atlantic Pigtoe is proposed for a Threatened listing under the Endangered Species Act, while the Brook Floater has been petitioned for federal listing. Current population and distribution data are essential to inform this process for both species. Existing records for Atlantic Pigtoe in the Cape Fear and Yadkin-Pee Dee river basins are sparse and most are over two decades old. Targeted surveys for Brook Floaters in the Cape Fear and lower Pee Dee systems were initiated in 2017. Timed qualitative searches were conducted during 100 site visits at 81 localities, where 32 Brook Floaters were collected from 11 streams. Catch per unit effort ranged from 0.16 to 3.5 individuals per person-hour and the species had a relative abundance of less than 0.3% out of all mussels collected. During these efforts, one Atlantic Pigtoe was located, the first live individual found in the Little River in Montgomery County since 1993. Surveys will continue in 2019 to increase geographic coverage, providing further data to guide management decisions.

Type: Lightning

Student or a Professional? Professional

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**Movement of Acoustic Tagged Largemouth Bass between Lake Mattamuskeet and Surrounding Canals
in Relation to Changes in Lake Level**

Kevin J. Dockendorf

North Carolina Wildlife Resources Commission, Inland Fisheries Division, Elizabeth City, NC

Largemouth Bass, *Micropterus salmoides*, are popular sportfish at Lake Mattamuskeet, a large (16,187 ha), shallow (mean depth < 1.0 m), lake surrounded by a system of canals at Mattamuskeet National Wildlife Refuge in Hyde County, North Carolina. Lower lake levels annually occur due to environmental (evaporation in summer) or anthropogenic (pumping for refuge impoundments and draining through water control structures) conditions may reduce available shoreline habitat for Largemouth Bass, whereas connecting canals are relatively deeper due to maintenance dredging and may provide alternative habitat when habitat in lake is reduced. The study objective is to define the temporal and spatial scale of Largemouth Bass movement with acoustic telemetry. Specifically, this study will test the hypothesis that Largemouth Bass movements into deeper, canal habitats are triggered by decreasing water levels in the main lake and dewatering of shoreline habitats. Between March and May 2017, a total of 31 VEMCO VR2W receivers were strategically placed in proximity to the canal connections to the lake. During May–June 2017, a total of 42 Largemouth Bass were collected, anesthetized, surgically implanted with VEMCO V9 acoustic transmitters (or tags), and released at seven locations; five in the lake and two in the canals. Receivers were checked monthly from May 2017 to October 2018 to download available data, service as necessary, and then redeployed. Receiver downloads between 15 May 2017 and 31 October 2018 revealed more than 616,000 detections of at least 29 acoustic-tagged Largemouth Bass at 30 of the acoustic receivers in the array. This survey will continue through February 2019 (extent of transmitter battery life) or until all acoustic-tagged Largemouth Bass are defined as dead. This study will provide valuable information regarding optimal water levels for Largemouth Bass in main lake habitats, while providing insights into environmental characteristics that elicit movement between available habitats.

Type: Full Presentation

Student or a Professional? Professional

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Sicklefin Redhorse Survival in the Little Tennessee River Basin

Jason Doll*¹ and Luke Etchison²
*Presenting

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² North Carolina Wildlife Resources Commission, Aquatic Wildlife Diversity Program, Waynesville, NC

The Sicklefin redhorse *Moxostoma sp.* was first discovered in 1992 and is found in the Little Tennessee and Hiwassee River systems in Cherokee, Clay, Swain, Macon, and Jackson counties. They are a federal candidate for listing and a state threatened species. Conservation efforts include propagation to reintroduce this species into unoccupied habitat and a dam removal on the mainstem of the Tuckasegee River. Previous research in the Tuckasegee River determined movement patterns and habitat use however; survival in the Little Tennessee River basin is unknown. The objective of this project was to determine survival of Sicklefin Redhorse in the Little Tennessee and Tuckasegee River. Fish were collected between 2007 and 2018 using electrofishing at fixed sites during their spawning migration. All collected fish were measured, weighted, sexed, and checked for PIT (passive integrated transponder) tags. PIT tags were inserted into all fish that did not have one. We used a Cormack-Jolly-Seber model to estimate apparent survival. We additionally examined differences between sex and river. A total of 1,222 Sicklefin Redhorse observations were made. Males outnumbered females in every year. Detectability was low and similar between sex. We found differences in apparent survival between sex with male apparent survival being higher than females in both rivers. Apparent survival was also higher in the Tuckasegee River compared to the Little Tennessee River regardless of sex. Apparent survival across years was variable and lowest in 2013 and 2015.

Type: Full Presentation

Student or a Professional? Professional

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Evaluation of Striped Bass Stocking at Badin Lake Using Parentage Based Genetic Tagging

Lawrence Dorsey

North Carolina Wildlife Resources Commission, Division of Inland Fisheries, Albemarle, NC

Stocking has been used since the 1970's to establish Striped Bass fisheries in reservoirs across the United States. While Striped Bass stocking has been evaluated previously using multiple metrics, no studies to date have looked at the contributions of specific stocking sites to the overall population in a reservoir. Parentage based tagging, which utilizes genetic information collected from broodstock, was used in this study to stock genetically unique cohorts of Striped Bass at three different stocking sites at Badin Lake, North Carolina from 2013—2016. Genetically unique cohorts of Striped Bass were also stocked in three reservoirs upstream of Badin Lake during this time as well to measure any immigration of Striped Bass from these reservoirs. Gillnetting and electrofishing were used to collect Striped Bass beginning in Fall 2014 and ending in Fall 2017. Percent contribution of Striped Bass from these stocking sites in our samples varied over time for all cohorts except for the 2016 cohort where only one sample collected these fish. However, pooled results from each cohort over the entire study suggested that no differences occurred in the percent contribution of Striped Bass from the stockings in 2013 and 2014 but differences were apparent in the contributions from the 2015 and 2016 stockings. Immigration of striped bass from upstream sources was detected in every sample and the percent contribution varied widely over the study. The results of this study indicate stocking site selection may be an important factor in successful reservoir Striped Bass fisheries and that immigration from upstream sources should be considered when management decisions are made.

Type: Full Presentation

Student or a Professional? Professional

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The Effect of Long-term Stocking Programs on Genetic Diversity

Heather K Evans*¹, Kara B Carlson¹, Kathryn M Potoka², and Jeremy W McCargo²
*Presenting

¹North Carolina Museum of Natural Sciences, Raleigh, NC

²North Carolina Wildlife Resources Commission, Raleigh, NC

American Shad, *Alosa sapidissima*, historically supported large, thriving commercial fisheries along the Atlantic coast. However, factors such as overfishing, loss of spawning grounds, and dam construction have severely depleted American Shad populations over approximately the last fifty years. Extensive restocking efforts in the Roanoke River were undertaken by the North Carolina Wildlife Resources Commission in an attempt to restore American Shad to their former numbers. As part of the evaluation of this restocking effort, we conducted genetic analyses using microsatellites on broodfish, young-of-year, and returning spawning adults over the last ten years. Our results demonstrate that hatchery efforts contribute to increasingly large percentages of returning, spawning adults, with 65.7% of returning adults in 2017 identified as hatchery-spawned fish. Furthermore, within any given year, a significant percentage of stocked fish can be attributed to only two or three hatchery breeding pairs. Thus, restocking efforts appear to create a limited breeding pool within the stocked river system. Additional analyses indicate that effective population sizes decreased as stocking efforts continued, with no significant increase in relative abundance. Thus, we recommend fisheries managers use caution when employing stocking programs and consider the long-term effects that resulting decreased genetic diversity may have on a species' ability to rebound.

Type: Full Presentation

Student or a Professional? Professional

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**Population Genetics of the Carolina Heelsplitter, *Lasmigona decorata*,
a Critically-Endangered Freshwater Mussel**

Victoria C. Fowler* and Michael M. Gangloff
*Presenting

Appalachian State University, Boone, NC

Freshwater mussel biodiversity has declined substantially in many southern Atlantic Slope streams during the last four decades and several species are now critically endangered. The Carolina Heelsplitter, *Lasmigona decorata*, is a federally-endangered freshwater mussel that historically occurred in the Pee Dee, Santee and Savannah basins in Georgia, North Carolina and South Carolina. Currently, Carolina Heelsplitters persist as small, isolated populations, primarily within the Charlotte and Carolina Slate Belt physiographic provinces. In order to assess range-wide genetic diversity among Carolina Heelsplitter populations, we obtained non-lethal DNA samples from wild animals and individuals in hatchery facilities and sequenced a portion of the mitochondrial COI gene. To date, we have generated and examined COI sequences from 95 Carolina Heelsplitters including 25 from the Catawba, 46 from the Pee Dee and 24 from the Savannah drainages. At the COI locus genetic variation in this species appears to be minimal (i.e., <0.23% pairwise divergence) both within populations and among river basins. Three haplotypes were identified from across the 6 populations examined. Two haplotypes were shared among populations in all three river basins, whereas the other haplotype was restricted to Goose and Duck creeks, tributaries to the Pee Dee River. These data provide evidence of widespread historical connections among Carolina Heelsplitter populations in the Pee Dee, Santee and Savannah drainages. This suggests that moving individuals among drainages seems unlikely to negatively impact populations and may prove to be an effective way of rescuing this species. Additionally, crossing individuals from the very small Goose and Duck creek populations with individuals from larger, more stable populations from other drainages (e.g., Lynches River) may provide a way to improve heterozygosity and perhaps introduce genes for increased tolerance to sedimentation or warmer water temperatures from these systems.

Type: Poster

Student or a Professional? Student

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Harris Lake Habitat Enhancement Project

Mark D. Fowlkes*¹, Clinton Morgeson², and Kirk Rundle³
*Presenting

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Harris Lake is a 1,680-ha impoundment of White Oak and Buckhorn creeks, tributaries of the Cape Fear River, and is located 35-km southwest of Raleigh, North Carolina. It is a productive eutrophic reservoir that supports a multi-species fishery consisting of Largemouth Bass *Micropterus salmoides*, Black Crappie *Pomoxis nigromaculatus*, sunfish species, Channel Catfish *Ictalurus punctatus*, White Catfish *Ameiurus catus*, Bullhead Catfishes *Ameiurus spp.*, and White Perch *Morone americana*. Bassmaster Magazine ranked it 4th in the nation for best bass lakes in America and first in the southeast region in 2017. Hydrilla *Hydrilla verticillata*, a federally noxious weed, has been in the reservoir since the late 1980's. It has been identified as a source population and Hydrilla has spread into other water bodies, including the Cape Fear River and Jordan Lake. To control Hydrilla, the North Carolina Division of Water Resources stocked 1,400 triploid Grass Carp *Ctenopharyngodon idella* in December 2018. The potential loss of habitat may result in changes in fish behavior and could decrease angler catch rates. Offering other natural and artificial structures, including native aquatic vegetation for fish to utilize could help maintain angler catch rates and satisfaction. The North Carolina Wildlife Resources Commission is leading efforts to improve aquatic habitat in the reservoir. The project objectives are to: 1) develop and implement a 5-year aquatic habitat enhancement project in Harris Lake with public input and assistance, and 2) establish and expand coverage of native aquatic macrophyte communities (0.4 hectare of founder colonies) and install at least 12 hectares of artificial and natural structure (≈700 fish attractors) to improve physical habitat by 2023. In 2018, the Commission installed ten additional artificial reef sites and planted aquatic vegetation at fourteen locations. We are currently seeking input from anglers and other partners on the 5-year Habitat Enhancement Plan for Harris Lake.

Type: Full Presentation

Student or a Professional? Professional

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**Analysis of Fish Collections Data Shows North Carolina Stream Fish Communities
are Influenced by Beaver Activity**

Samuel Fritz*, Michael Gangloff, Michael Madritch, and Robert Creed
*Presenting

Appalachian State University, Boone, NC

Beavers (*Castor canadensis*) are ecosystem engineers, and their dam building activities may cause dramatic changes to aquatic habitats. These habitat alterations affect stream communities through complex mechanisms, which are often dependent on local natural history and geography. The Southeastern United States is a global hotspot for temperate freshwater fish diversity, but little research has been conducted on beaver-fish interactions in the region. To better understand how beavers affect southeastern fish communities we examined collection records from 32 beaver-impacted Piedmont and Coastal Plain streams in east-central North Carolina. Each stream had at least one sample in proximity to a beaver dam and another within an unimpounded reach. A Wilcoxon rank sum test showed that reaches in close proximity to active beaver dams had lower species richness compared with free-flowing reaches ($p < 0.0002$). A Dufrene-Legendre indicator species analysis showed that five species *Erimyzon oblongus*, *E. sucetta*, *Ictalurus punctatus*, *Lepomis gibbosus*, and *L. macrochirus* were significantly more abundant in samples from reaches without dams compared with reaches with dams ($p < 0.05$ for all taxa). Our results indicate that beaver dams may reduce habitat suitability for the fishes identified by the indicator species analysis. Although none of the fishes identified are species of elevated conservation concern, several are important sportfish.

Type: Poster

Student or a Professional? Student

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Estimating Stock Structure of Cobia, *Rachycentron canadum*, Using Acoustic Telemetry

Riley M. Gallagher*, Jacob R. Krause, and Jeffrey A. Buckel
*Presenting

Department of Applied Ecology, Center for Marine Sciences and Technology, North Carolina State University,
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Cobia, *Rachycentron canadum*, is a large pelagic fish whose landings have increased in recent years due to its popularity with recreational anglers. The South Atlantic Fisheries Management Council recently transferred Cobia management to the Atlantic States Marine Fisheries Commission, largely in response to a contentious federal closure of the Cobia fishery in 2016. Management transitions have led to a call for more research on (1) subpopulations of cobia within the southeastern US (SEUS; e.g. inshore-offshore migrations vs north-south migrations) and (2) the geographic boundary for SEUS and Gulf of Mexico Cobia stocks. As part of a coast-wide initiative among multiple investigators, we are using telemetry tagging in North Carolina (NC) and Virginia (VA) and receiver arrays (ours in NC and other PIs in other states) to address questions about stock structure and boundary. In 2018, NC State University tagging crews telemetry tagged 54 Cobia and have detected 34 of the tagged individuals on receiver arrays between Florida and Maryland. Our findings will be important for future SEUS Cobia stock assessments and management.

Type: Poster
Student or a Professional? Student
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The Relationship Between Mesohabitat Structure and Mussel Communities in East Texas Rivers

Andrew R. Glen^{1*}, Lance Williams², and Neil B. Ford²
*Presenting

¹ North Carolina Wildlife Resources Commission, Aquatic Wildlife Diversity Program, Mebane, NC

² Department of Biology, University of Texas at Tyler, Tyler, TX

Freshwater mussels are considered one of the most imperiled group of organisms in North America, however basic questions concerning their ecology remain to be answered. Many hypotheses have been proposed to explain the spatial distribution of mussels within a stream reach, however many have failed to find support. Emerging evidence indicates that freshwater mussels may use flow refugia to remain embedded in the stream. Considering hydraulic variables may be important, and it could be useful to implement them into sampling. One option is a Basin Visual Estimation Technique (BVET) that classifies a reach by riffles, pools, and runs. We sampled populations of freshwater mussels using this sampling scheme in order to investigate habitat associations and how shear stress impacts community structure. We sampled 31 sites along the upper Neches River in Texas through quadrats and the collection of site-specific environmental data. Three-way log-linear contingency tables were developed and analyzed using a χ^2 test to elucidate if associations between species, environmental characteristics, and mesohabitats were occurring. The results suggest that numerous species do associate with mesohabitats and are associated with certain environmental characteristics and areas of low shear stress. A shift in community structure was demonstrated in areas exhibiting minimal entrenchment and low shear stress. We feel that implementing sampling protocols that use classification by mesohabitats may help managers determine habitat associations for a wide array of freshwater mussels.

Type: Full Presentation

Student or a Professional? Professional

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Culvert Replacement - Applied Genetic Diversity

Damon Hearn¹ and Ned Jones^{2*}
*Presenting

¹Trout Unlimited
²Triangle Fly fishers

This will be a slide presentation on culvert replacement on Buck Creek in the Nantahala National Forest. This is truly applied genetic diversity.

Type: Lightning Talk

Student or a Professional? Citizen activist

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Freshwater Mussel Surveys in the Catawba River System

Ryan J. Heise*¹ and William T. Russ²
*Presenting

¹Duke Energy, Environmental Services, Huntersville, NC,

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In 2018, Duke Energy and NC WRC conducted freshwater mussel surveys in the mainstem of the Catawba River from the headwaters downstream to the NC/SC state line. These surveys are part of Duke Energy's Federal Energy Regulatory Commission License and the Catawba-Wateree Relicensing Agreement. This sampling occurs once every three years for the term of the License (40 years) and will enable us to track mussel populations and analyze trends.

Type: Lightning

Student or a Professional? Professional

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Did You Look Hard Enough? A Case Study of Mussel Detection Efficiency in a Piedmont River

Brena K. Jones

North Carolina Wildlife Resources Commission, Creedmoor, NC

Data produced by qualitative surveys for cryptic species, such as freshwater mussels, tell an incomplete story, due to the limitations of human detection ability. This is exacerbated by complex habitats and surveyor bias. The consequences may include errors in interpretation of abundance, distribution, and community diversity. Incorporating and quantifying imperfect detection into data modeling and analyses is becoming more common, but application to mussel work lags behind. While qualitative surveys, the most commonly conducted in NC, are generally timed, few guidelines are available on what constitutes sufficient effort to characterize the desired population parameter at a given locality. Data from an intensive, multi-visit 2018 mussel relocation effort in four adjacent reaches of the Rocky River (Chatham County) illustrate the need for continued diligence in survey design and execution. Mussels collected on the first pass comprised as little as 35 to 64% of the total number captured per reach. In three reaches, catch per unit effort increased on the second pass. Multiple surveys were required to document all known state listed species.

Use and interpretation of existing datasets should be tempered with careful scrutiny of the associated effort, as these data are often used to make decisions regarding listed species management, permitting recommendations, and mitigation requirements. Resource managers should also consider implementation of regionally appropriate minimum survey criteria, encouraging more consistent datasets and greater return on invested survey efforts.

Type: Full Presentation

Student or a Professional? Professional

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Introduction to Visual Sampling Plan a Free Sampling Software

Ned Jones

1-Alpha Solutions, Wake Forest, NC

This will be an introduction of Visual Sample Plan (VSP). VSP is a free downloadable software that aids the user to develop a sample plan based on sound statistical sampling theory and statistical analysis to support well-grounded decisions. VSP allows the user to combine visualization of sample location with optimal sampling design and statistical analysis strategies. VSP is currently focused on design and analysis for the following applications:

- Environmental Characterization and Remediation.
- Environmental Monitoring and Stewardship,
- Response and Recovery of Chemical/Biological/Radiation Terrorist Event,
- Footprint Reduction and Remediation of Unexploded Ordnance (UXO) Sites,
- Sampling of Soils, Buildings, Groundwater, Sediment, Surface Water, Subsurface Layers.

VSP helps the user to answer these essential questions. How many samples should be taken and where should I take these samples in the sample area. VSP also helps the user understand what decisions the sample data support and provides statistical analysis to help the user know how much confidence he can have in those decisions.

VSP is a software tool developed by Pacific Northwest National Laboratory (PNNL), initially conceived and sponsored through the DOE. Since then following sponsors have been added DHS, EPA, DoD, CDC, and United Kingdom.

Reference

VSP Development Team (2019), Visual Sampling Plan, A Tool for Design and Analysis of Environmental Sampling. Version 7.11b, Pacific Northwest National Laboratory, Richland, WA <https://vsp.pnnl.gov/>

Type: Full Presentation

Student or a Professional? Professional (Retired)

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Variability of Striped Bass Egg Characteristics in North Carolina Coastal Rivers

Cara K. Kowalchyk*, Jesse R. Fischer, and Benjamin J. Reading
*Presenting

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Striped Bass is an important recreational and commercial species native to North Carolina; however, limitations to natural recruitment in the Tar, Neuse, and Cape Fear Rivers are not well understood while Roanoke River recruitment remains relatively consistent. Early developmental stages of Striped Bass are influenced by several factors including egg characteristics (e.g., buoyancy, size) and may be directly and indirectly regulated by environmental conditions. To understand if physical egg characteristics may contribute to recruitment failure of migratory Striped Bass populations, fertilized eggs were collected from female Striped Bass during hatchery propagation from all four major river systems in North Carolina. Fertilized eggs collected from different developmental stages were measured for size, proportion of yolk, and specific gravity. Differences in mean neutral buoyancy of stage-1 eggs was observed with Roanoke River broodstock producing fertilized eggs with greater buoyancy than Neuse River broodstock ($p=0.0107$). Egg yolk composition of three key vitellogenin proteins (VtgAa, VtgAb, VtgC), that have been shown to determine egg buoyancy and critically timed nutrient delivery to embryos, will be analyzed with tandem mass spectrophotometry for protein discovery and quantification. The results from these concurrent analyses will be used to determine if egg characteristics of Striped Bass in North Carolina are genetically influenced, are an environmental-physiological response to water salinity, or are a combination of these factors to guide future management decisions.

Type: Full Presentation

Student or a Professional? Student

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**Population Characteristics and Simulated Exploitation Responses of Common Carp, *Cyprinus carpio*,
in Lake Mattamuskeet**

April D. Lamb* and Jesse R. Fischer
*Presenting

North Carolina State University, Department of Applied Ecology, Raleigh, NC

Common Carp (hereafter “carp”) are one of the most widely introduced and ecologically disruptive freshwater fish species. Carp populations are known to increase turbidity, alter nutrient dynamics, and re-suspend sediment into the water column through the direct consumption and uprooting of aquatic vegetation while foraging. These effects are most pronounced in shallow lake ecosystems typically dominated by submerged aquatic vegetation and have been reversed in smaller systems via lake-wide carp removals. Despite improvements to water quality and macrophyte cover, incomplete removals are often short-lived as carp exhibit rapid growth and early maturation, allowing populations to rebound following removal efforts. An alternative to this approach is developing an adaptive management plan that utilizes a suite of restoration strategies in tandem with repeated carp removals intended to reduce population numbers to an unsustainable level. One system that could benefit from such a plan is Lake Mattamuskeet in eastern North Carolina, which has recently experienced a lake-wide loss of all submerged aquatic vegetation, a decline in water quality, and the increased occurrence and severity of toxic algal blooms. Beyond historical accounts of carp removal efforts, population-level information has been unexplored for carp in Lake Mattamuskeet, warranting further research before management actions can be enacted. In this study, we provide critical baseline history data of carp in Lake Mattamuskeet by developing age-structured population models to evaluate simulated exploitation levels necessary to cause recruitment failure and minimize carp-removal efforts. Specifically, calcified bony structures (dorsal spines) were collected in 2016 (n = 193), 2017 (n = 87), and 2018 (n = 86), cross-sectioned, aged, and measured by two readers on a dissecting scope to determine age structure, growth, and mortality estimates of carp. Additional population parameters (sex-ratios, etc) were also identified and used to predict the most vulnerable life stages and population responses to exploitation.

Type: Full Presentation

Student or a Professional? Student

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Phylogeographic Patterns Among the Lanceolate *Elliptio* Species Complex

Hans R. Lohmeyer*, Michael M. Gangloff, Victoria C. Fowler, Jon. D. Wells, and Gretchen. L. Bailey
*Presenting

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DNA sequencing has provided many new opportunities to improve our understanding of how species are related and integrating molecular, morphological and biogeographic data can help better elucidate species boundaries and phylogenetic relationships. However, this approach may add complexity to field research it may improve the ability of biologists to recognize species using comparisons of phenotypic attributes. The extreme amount of morphological variation observed among *Elliptio* species has led to the proliferation of a plethora of species names and generated a long-running debate about the phylogenetic structure within this genus. Although earlier workers including Johnson considered *Elliptio* to be comprised of three species complexes; *E. complanata*, *E. icterina* and *E. lanceolata*, current species lists recognize 30 *Elliptio* taxa including seven taxa in the lanceolate group. We examined portions of the mitochondrial NADH dehydrogenase (ND1) and cytochrome oxidase c₁ (CO1) genes from >400 specimens and 6 species within the lanceolate *Elliptio* complex from 13 Atlantic Slope river basins. We constructed haplotype networks to examine species boundaries and the degree of genetic exchange among putative species. Our data reveal that *E. lanceolata* is genetically distinct from other lances. However, many other taxa in the lanceolate *Elliptio* complex exhibit evidence of substantial historical genetic exchange and likely do not comprise biologically distinct species. We found support for a northern *E. fisheriana* and a southern *E. angustata* lance clade with a boundary somewhere in the Pamlico Sound drainages. However, due to small sample sizes it is unclear whether lance taxa from drainages south of the Savannah River (e.g., *E. aheanea* and *E. sherpardiana*) are genetically distinct. Future work will involve sampling lances from drainages in Georgia and Florida and the use of microsatellite or next generation approaches to examine fine-scale resolution of lanceolate *Elliptio* taxa.

Type: Poster

Student or a Professional? Student

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Preventing Extinction of the Carolina Madtom, *Noturus furiosus*

Sarah McRae*¹, Tyler Black², and J.R. Shute³
*Presenting

¹U.S. Fish and Wildlife Service, Raleigh, NC

²North Carolina Wildlife Resources Commission, Raleigh, NC

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This collaborative project's goal is to collect broodstock and develop propagation and husbandry protocols for the Carolina Madtom, *Noturus furiosus* for future potential reintroductions and maintenance of ark populations. In 2018, NCWRC staff collected one adult from the Neuse River system and four adults and several hatched/unhatched larvae from the Tar River system and transferred to CFI. These fish will be used to develop propagation protocols and hopefully to produce progeny for stocking efforts or initiation of ark populations. The need for this action is urgent due to the rapid decline and extirpation of wild Carolina Madtom populations following the introduction and dispersal of the nonindigenous and highly predatory Flathead Catfish, *Pylodictis olivaris*. The development of propagation protocols appears to be the only means to prevent impending extinction of the species. These will provide the necessary information and techniques required to establish and maintain ark populations that could then be utilized for species preservation and potential restorations. This is an ongoing project, likely to continue through 2020.

Type: Lightning Talk

Student or a Professional? Professional

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Lake Gaston Catfish Sampling Update

Clint W. Morgeson* and Kirk Rundle
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North Carolina Wildlife Resources Commission, Raleigh, NC

Outside of their native ranges, nonnative catfish (e.g. Blue Catfish *Ictalurus furcatus*, Flathead Catfish *Pylodictis olivaris*) introductions have had measurable impacts on native fish communities. However, given their abundance and large size, these catfish species have become popular among anglers in the state. Compared to other North Carolina Piedmont reservoirs, the Blue Catfish invasion of Lake Gaston, which straddles the North Carolina–Virginia state line in the Roanoke River Basin, was unintentional and relatively recent, with the founding individuals sampled in the early 2000s. Their establishment has been swift and noteworthy, subsequently producing three consecutive state record Blue Catfish in 2015 and 2016, the latest weighing over 117 pounds. A commercial fishery of Blue Catfish has also been established on Lake Gaston, with few restrictions due to the nongame status of the species. Recently, a trophy regulation limiting anglers to possessing one Blue Catfish over 32 inches was established in response to growing angler concerns regarding overexploitation. The North Carolina Wildlife Resources Commission initiated catfish sampling efforts in 2016 including electrofishing, gill netting, and juglines. Size, age, growth, and mortality are being determined and compared among other established reservoir Blue Catfish populations. Preliminary data suggest sampled Blue Catfish in 2017 were on average over 10 years of age and up to 20 years of age; large individuals over 32 inches accounted for 6% of the biological samples. Often native catfish species (e.g. *Ameiurus* spp.) are displaced by nonnative catfish introductions, however, White Catfish *A. catus* and other bullhead species are still documented throughout the reservoir. Because balancing native species conservation and angler desires can be a challenging, ongoing process, this research aims to set the baseline for the continued science-based catfish management in Lake Gaston.

Type: Lightning Talk

Student or a Professional? Professional

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Indirect Impacts of Modern Bass Fishing: Looking Past Traditional Bass Population Dynamics

Seth Mycko

North Carolina Wildlife Resources Commission, Division of Inland Fisheries, Raleigh, NC

In recent history, large scale tournament organizations and other bass angling associations have led the way in transforming bass angling into a culture of catch and release, 'conservation based,' fishing. Fishery managers are increasingly tasked with managing lakes and rivers where bass harvest is low resulting in populations that are large and sometimes stunted. Harvest of bass may no longer be the driving force of recruitment to the asymptote of growth curves. Traditional population models usually estimate recruitment of bass to the harvestable portion of the population under the assumption that the larger fish are being removed by anglers. While a healthy amount of harvest is still true for some NC fisheries (e.g. Lake Sutton in New Hanover County), the new fishing cultures may begin to make the traditional harvest assumptions false for some of the most popular bass fisheries in the state. The North Carolina Wildlife Resource Commission has historic data collected over the last 30 years on size structure, body condition, growth rates, and age of black bass populations. Using this historic data, I describe a new approach for NC fishery managers to attempt to monitor long term trends in bass recruitment by testing how factors like assumed catch-and-release fishing pressure influence bass recruitment during years when no creel data is available to verify any harvest or other mortality assumptions. This tactic could help predict population fluctuations and allow biologists to predict certain outcomes when managing lakes that may have increasing bass survivorship in the future.

Type: Lightning Talk

Student or a Professional? Professional

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**Phylogenetic Survey of Crayfish in the Catawba River Basin Reveals a New Species
Endemic to the South Mountains of Western North Carolina**

Michael A. Perkins*¹, Bronwyn W. Williams², and William T. Russ¹
*Presenting

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A new species of stream-dwelling crayfish, *Cambarus franklini*, the South Mountains crayfish, is currently being described from the upper South Fork Catawba River basin in western North Carolina, using morphological and genetic data. *Cambarus franklini* was previously considered a member of the widespread and highly variable *Cambarus* species C complex and is morphologically most similar to an unnamed member of the group native to the upper Catawba River basin in NC. This species is phylogenetically most similar to *Cambarus johni*, another former member of the *Cambarus* species C group. *Cambarus franklini* has a limited geographic range (<500 km²) and is currently known only from the Henry and Jacob Fork watersheds in the South Mountains region of the Eastern Blue Ridge foothills.

Type: Lightning Talk

Student or a Professional? Professional

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The White Lake Fish Kill: Cause, Context, and Implications

Kyle T. Rachels

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White Lake is a 430-ha Carolina Bay managed by the N.C. Division of Parks and Recreation. On May 3, 2018, a contractor for the Town of White Lake commenced application of buffered aluminum sulfate (alum) to strip phosphorus and flocculate algae from the water column of White Lake. The following day, the N.C. Wildlife Resources Commission was notified of a fish kill in progress. NCWRC staff collected dead fish along six randomly selected shoreline transects and six across-lake transects. Total estimated loss was 114,770 fish from 9 species with a replacement value of \$634,132. The N.C. Division of Water Resources determined "High pH values and fluctuating DO concentration from the existing algal bloom combined with the site-specific effects of the alum treatment caused the fish kill." An electrofishing survey conducted in October 2018 collected 5 of the 9 species documented in the fish kill. Electrofishing surveys will be conducted in spring and fall 2019 to monitor fish community recovery.

Type: Full Presentation

Student or a Professional? Professional

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Fisheries Impacts of Hurricane Florence

Kyle T. Rachels

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Hurricane Florence made landfall near Wrightsville Beach on September 14, 2018 as a Category I storm. It was the second-wettest hurricane ever recorded in the United States, with maximum rainfall exceeding 35 inches at one location. Peak stream discharge records were observed at 18 USGS gauge stations in North Carolina. Notable new discharge records include the Waccamaw River (53,600cfs; previous record 31,200cfs) and Black River (54,000cfs; previous record 28,500cfs). Dissolved oxygen in the Northeast Cape Fear and Waccamaw rivers remained below 1.0 mg/L for over 30 days. Substantial fish kills were observed in the Cape Fear, Northeast Cape Fear, and Waccamaw rivers, with minor fish kills reported in many rivers, lakes, and ponds east of Interstate 95 and as far north as Elizabeth City. Approximately one dozen Atlantic Sturgeon were confirmed dead in the lower Cape Fear River, with additional Atlantic Sturgeon confirmed dead in Albemarle Sound. The magnitude of the impacts to freshwater and diadromous fish species will require long-term monitoring and implementation of management measures to facilitate recovery, especially for threatened and endangered species.

Type: Lightning

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**Evaluation of Coded Wire Tag Retention in Brown Trout, *Salmo trutta*, Fingerlings
Tagged at Three Anatomical Locations**

Jacob Rash*¹, David Goodfred¹, and Edward Jones, Jr²
*Presenting

¹North Carolina Wildlife Resources Commission, Inland Fisheries Division, Marion, NC
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We evaluated coded wire tags placed at three different anatomical locations (left cheek, right cheek and snout) in Brown Trout, *Salmo trutta*, fingerlings (range of mean annual total lengths = 81.31 – 101.89 mm) prior to stockings (10,000 fish per tagging location). We determined the probability of tag retention at zero, 87 and 176 days post tagging across mean fish lengths. Anatomical tagging location influenced the probability of a fish being tagged. At all evaluation periods and for all mean sizes, Brown Trout fingerlings tagged in the left cheek had higher probabilities of being tagged than other positions of tags, with snout tags performing the worst. Intra-location comparisons revealed a decline in tag retention across temporal scales. Days post tagging had a negative effect on probability of tag retention, while length had a positive effect on the probability of tag retention. Our results indicated that the likelihood of a tag being present at 176 days was influenced by position of tag and initial tagging success more so than length or days post tagging. Although tag retention was generally high across all tag positions, differences in retention revealed the need to refine the tagging procedure. In addition, the underperformance of coded wire tags placed in the snout suggested that alternative marking locations should be explored.

Type: Lightning

Student or a Professional? Professional

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Estimating Appalachian Elktoe, *Alasmidonta raveneliana*, Abundance and Occupancy in the South Toe River, NC

Chantelle L. Rondel*¹, Jason Mays² and Michael M. Gangloff¹
*Presenting

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Understanding how environmental factors affect species abundance and occupancy is an important but under-appreciated aspect of endangered species management and yet surprisingly few studies have attempted to quantify the size of freshwater mussel populations or examine differences in detectability. The Appalachian Elktoe (*Alasmidonta raveneliana*) is an endangered freshwater mussel endemic to the upper Tennessee River Drainage. Beginning in 2014, we began annual monitoring of Appalachian Elktoe populations at six sites in the South Toe River and starting in Summer 2015 these sites were sampled multiple times each year to quantify seasonal differences in detectability. Appalachian Elktoe abundance was highly variable among years and was typically highest during late spring and lowest during fall surveys. In order to obtain more robust estimates of Elktoe abundance we began a 3-pass mark-recapture study at 6 long-term monitoring sites and a more broadly focused study designed to elktoe occupancy in 17 additional reaches of the South Toe River. Preliminary elktoe population estimates at the 6 long-term monitoring sites ranged from 458-580. The occupancy study revealed 9 new elktoe populations in the South Toe River. Appalachian Elktoe were detected at 15 of 23 sites (65%) across the South Toe River and a total of 634 mussels at all 23 sites. Three-pass mark-recapture estimates produced population estimates that were 43-225% higher than single-pass estimates. These findings have important implications for South Toe elktoe populations. First, it appears that single-pass estimates substantially underestimate mussel abundance and that additional large populations exist in this stream. Second, the discovery of additional populations in the middle reaches suggests that population resiliency may be greater than previously thought. Finally, because most of the newly-detected populations were found in relatively isolated and well-forested reaches they may be buffered against the impacts of development occurring elsewhere in the South Toe watershed.

Type: Full Presentation

Student or a Professional? Student

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Assessing the Recovery of Freshwater Mussel Populations Following Dam Removals

Vincent Santini* and Michael Gangloff
*Presenting

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Dam removal has many obvious benefits to stream ecosystems and biota including increased connectivity as well as improvements to water and habitat quality. However, funding for post-removal monitoring is often limited or non-existent and few studies have quantified the effects of short or long-term impacts of removals on stream faunas. Additionally, surprisingly few dam removal projects quantified pre- or post-removal mussel populations or measured changes in stream physical habitat conditions and so it is difficult to determine whether dam removals benefit or harm freshwater mussel populations. Our goal is to address this information gap by examining the long-term impacts of dam removal on freshwater mussel populations in the eastern US. We have compiled information on 185 dam removal projects across 22 states conducted during the last two decades. Although we were only able to find mussel survey information on 29 out of the 185 dams that support freshwater mussel populations, pre-removal studies were conducted in only 13 (~ 48%) of these systems. The number of projects with post removal studies is larger (22 projects, ~ 76%). During summer and fall 2019 we will conduct mussel surveys in streams where dam removals occurred in order to better understand the long-term consequences of these actions. Surveys will be conducted in the former dam tailwater reach as well as at reference sites up- and downstream of the former impoundment. We will prioritize sites where pre-impoundment mussel surveys were conducted but our study design does not necessitate the existence of pre-removal data. We seek to collaborate with state and federal agencies that have been involved with past removal projects in streams supporting freshwater mussels. Data from this study will provide important context for understanding the time frame for recovery of mussel populations following dam removals as well as provide guidance for future dam-removal projects.

Type: Poster

Student or a Professional? Student

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**Assessing Aquatic Faunal Response to Dam Removal:
Milburnie Dam Removal Species Year-1 Monitoring Overview**

Timothy W. Savidge* and Tom E. Dickinson
*Presenting

Three Oaks Engineering, Durham, NC

The Milburnie Dam on the Neuse River near Raleigh North Carolina was removed in the fall of 2017 to establish the Milburnie Dam Mitigation Bank. The removal is expected to restore 32,590 linear feet of river to lotic conditions. Project specific Performance Standards have been established by Dam Removal Task Force for the bank and fall into three main restoration categories: 1) “appropriate aquatic community” criteria, 2) “Rare, Endangered and Threatened (RTE) Species and 3) water quality improvements. Additional site-specific mitigation credits can also be awarded from other benefits, such as restoration of anadromous species passage, demonstrated downstream benefits and human benefits such as independent research, or increased recreational value. A seven-year monitoring protocol began in 2018 to determine if the removal project’s restoration goals are achieved. Anadromous fish species and appropriate fish communities comprised the Year-1 monitoring and success metrics for both categories were demonstrated. Once success metrics are achieved for the determined number of monitoring periods, mitigation credits will then be released. The details of the Year- 1 monitoring results will be presented.

Type: Lightning

Student or a Professional? Professional

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Rocky River Dam Removal: Opportunities, Concerns, and Lessons Learned

Vann F. Stancil*¹, Brena K. Jones², and Aaron L. Aho³
*Presenting

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Removing dams can be an effective way to restore river systems and increase available habitat for imperiled aquatic species. Since 1990, 25 dams have been removed in North Carolina and additional dams are currently targeted for removal. Hoosier Dam, a 25-foot high hydroelectric dam on the Rocky River in Chatham County, was removed in fall 2018. This project was coordinated by Unique Places, LLC and funded by a National Fish and Wildlife Foundation grant; demolition was conducted by the US Fish and Wildlife Service Fish Passage team. Removing Hoosier Dam reconnected two reaches of federally designated Critical Habitat for the endangered Cape Fear Shiner, *Notropis mekistocholes*, and restored three miles of riverine habitat within the former impoundment. The reach downstream of Hoosier Dam contained several state listed mussel species, notably the state endangered Savannah Lilliput, *Toxolasma pullus*. Prior to demolition, rare mussels found downstream of the dam were relocated to suitable, occupied habitat above the impoundment to mitigate potential impacts from sediment deposition or elevated turbidity resulting from impoundment releases, bank erosion, and removal activities. While areas downstream of dams are often sediment starved because fine materials are deposited in impoundments, these areas are buffered from excessive sedimentation and can provide beneficial habitat conditions for freshwater mussels. When evaluating sediment management options for a dam removal project, the cost and feasibility of stabilization measures or mechanical sediment removal should be considered in the context of potential downstream effects of released materials.

Type: Full Presentation

Student or a Professional? Professional

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Monitoring Changes to Interstitial Sediments in the South Toe River Using Freeze Cores

Michael Thompson*¹, Chantelle Rondel¹, Jason Mays², and Michael Gangloff¹
*Presenting

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Fine sediments are widely believed to impact freshwater biodiversity, however, quantifying fine sediment composition at a scale that is meaningful to interstitial invertebrates can be challenging. The South Toe River is a headwater of the Tennessee River in western North Carolina and supports a population of endangered Appalachian Elktoe, *Alasmidonta raveneliana*, mussels. As part of a larger project to assess impacts of a highway expansion project on this stream we are monitoring surface and interstitial sediment composition using freeze-core sampling. Mussel populations, instream habitat (including surface substrate composition) and interstitial sediments were quantified at 6 long-term monitoring sites in the South Toe River beginning in spring 2017. Freeze cores were collected by pounding galvanized iron tubes into the streambed and filling them with crushed dry ice. Tubes were left in place for 20 minutes before being extracted from the substrate. Sediments remaining on each tube were removed, dried, sieved and weighed. We computed the proportion of each sediment size fraction retained on sieves. Surface substrate composition was highly variable both among sites and seasons but did not exhibit any meaningful longitudinal trends. In contrast, the concentration of interstitial fines was highest downstream of Little Crabtree Creek, a heavily-impacted stream flowing through the highway road cut. Downstream of Little Crabtree Creek the concentration of interstitial fines measured at 7.78%, compared to 2.50% at all remaining sites. These data suggest that highway construction projects have impacts on freshwater mussel habitats that may be undetectable using conventional methods of habitat measurement (i.e., Wolman pebble counts). Additionally, they suggest that freeze cores are a viable method for sampling interstitial substrates in montane streams and provide insights into habitat changes that may not be evident from measurements of surface substrate conditions.

Type: Full Presentation

Student or a Professional? Student

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Ghost of Ichthyologists Past - The Longear Sunfish, *Lepomis megalotis*, in North Carolina

Bryn H. Tracy*¹, Gabriela M. Hogue², and Fritz C. Rohde³

*Presenting

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The Longear Sunfish, *Lepomis megalotis* (Rafinesque, 1820), was first reported from North Carolina by Cope in 1870 "*from the upper waters of the French broad*" (Cope 1870), but vouchered specimens, collected by Cope, do not exist. In addition, nine lots (totaling 15 specimens) at various museums that were originally identified as Longear Sunfish were not. Four lots collected in the 1930s and 1940s from the North Fork Swannanoa River and the Swannanoa River in Buncombe County and from Pisgah Forest Lake in Transylvania County (ANSP Catalogue Nos. 61185, 61186, 61203, and 86937) were recently re-identified as Redbreast Sunfish, *Lepomis auritus* (Linnaeus 1758). Two lots reported by Menhinick (1986) and Menhinick (1997) collected in the 1940s from Richland Creek downstream from Lake Junaluska (Haywood County) were based upon material subsequently identified as Redbreast Sunfish (UMMZ Catalogue Nos. 131443 and 131444). Other lots from the 1960s-1980s (OSUM 59649, UF 64883, and INHS 27116) have also turned out to be Redbreast Sunfish. If Longear Sunfish ever occurred in North Carolina's (NC) western mountain river systems, these populations would have been on the extreme eastern edge of the species range (Bauer 1980). Various publications over the years have reported the Longear Sunfish as being extirpated from the state (e.g., Menhinick 1986; Menhinick 1991; Menhinick 1997; NCNHP 2018), possibly because of competition with Redbreast Sunfish, which is non-indigenous to NC western mountain river systems. However, except for Cope's anecdotal record, there is no evidence that Longear Sunfish, historically or more recently, ever occurred in North Carolina. This presentation will expand upon the historical "ghost sightings", the propagation of these identification records through time because of similarities between species, and evidence supporting the true distribution of Longear Sunfish.

Type: Full Presentation

Student or a Professional? Professional (retired)

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Preliminary Studies on the *In-Vitro* Culture of Yellow Lance, *Elliptio lanceolata*

Michael J. Walter* and Jay Levine
*Presenting

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The Yellow Lance, *Elliptio lanceolata*, is a federally threatened species of freshwater mussel found in the Atlantic Slope drainage from Maryland to North Carolina. The Yellow Lance was recently the subject of propagation and population augmentation efforts in the Tar and Neuse River basins in North Carolina. Traditionally, propagation is achieved *via* infestation of host fish in a laboratory. The infested fish are held until glochidia transformation is complete and the resulting juveniles are collected as they drop from the host fish. However, transformation is also possible using cell culture techniques. *In-vitro* propagation bypasses the host fish requirement of traditional propagation methods by holding glochidia in sterile media consisting of blood serum, basal medium and antibiotics/antimycotics. We present preliminary results of a 2018 Yellow Lance *in-vitro* propagation effort. Filter sterilized media was made using 25% Horse Serum, 75% M199 Basal Media, 100 µg/mL Gentamicin, 1 µg/mL Amphotericin B and 100 µg/mL Rifampicin. Yellow Lance glochidia were held in a CO₂ infused incubator at 23°C and 3% CO₂ receiving 2/3 media replacement every other day until transformation was completed after 15 days. Upon transformation, media was diluted using buffered dechlorinated water at a rate of 25%/hour before transferring juveniles to nested bucket grow out systems. Overall survival of juvenile Yellow Lance propagated *in-vitro* and *in-vivo* was low in 2018. As of 1/16/19, 204 individuals were alive with an average size of 27.19 mm (4.83 mm std dev). Alternative methods to optimize media dilution rate and improve *in-vitro* propagation success are being assessed and will be presented.

Type: Lightning

Student or a Professional? Student

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Engaging North Carolina's Trout Anglers to Help Conserve Eastern Hellbenders

Lori A. Williams¹, Jacob M. Rash*², John D. Groves³, Lorie L. Stroup⁴, and Doug Blatny⁵
*Presenting

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⁵North Carolina Division of Parks and Recreation, New River State Park

Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*) is a protected species of concern in North Carolina. Despite long-term efforts by the North Carolina Wildlife Resources Commission (NCWRC) and partners to improve understanding of hellbender status in the state, census of all known and potential populations is lacking. The species' dependence upon clean, cold, well-oxygenated water relegates them to North Carolina's Blue Ridge Ecoregion, where the State's trout fisheries share the same habitat requirements. This overlap presented an opportunity for the NCWRC to inform trout anglers about hellbender conservation, while enhancing spatial and temporal distribution data of the salamander. In 2013, an advertisement within the Public Mountain Trout Waters' portion of the *North Carolina Inland Fishing, Hunting and Trapping Regulations Digest* initiated direct outreach to trout anglers. This advertisement complemented existing outreach efforts that included informational posters, streamside signage, in-person programming and information tables, popular articles, and documentaries from summer 2007–summer 2017. These combined efforts, particularly the advertisement, have resulted in 207 reports of hellbenders from the public, with 127 from anglers. These data represent observations from 56 streams, with seven reports from waters that lacked previous knowledge of hellbender occurrence. The majority of reports originated from private land sites (n=117) and those within National Forests (n=70), while the encounter method reported most often was incidental observation (n=165). Much work remains relative to hellbender conservation in the State and region, but managers should consider exploring similar resource overlaps as those noted within our example to collect valuable data and promote conservation messages.

Type: Full Presentation

Student or a Professional? Professional

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Muskellunge Angler Success on Western North Carolina Waters

David L. Yow

Western North Carolina Muskie Club

Since 2006, members of the Western North Carolina Muskie Club have recorded numbers and lengths of Muskellunge *Esox masquinongy* as part of an annual, year-long club fishing tournament. Beginning in 2012, club members began recording fishing effort in addition to catch and length data. Additional fishing trip data recorded included date, body of water, and size of the fishing party, allowing calculation of monthly and annual catch rates for specific western North Carolina waters. Overall, Muskellunge fisheries are characterized by low catch rates (>0.05 fish/h). The French Broad River consistently sustains the highest reported annual fishing effort of all waters surveyed, and French Broad anglers typically achieve a higher, more consistent catch rate than that reported from other water bodies. Continued annual tournament records will provide a long-term dataset that may indicate fishery responses to changes in access, management, or other factors on specific waters. Limitations of club tournament data include limited transferability to the greater angler population and the lack of harvest information due to tournament prohibition of muskellunge harvest.

Type: Poster

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