Southeastern Fishes Council 2014 Annual Meeting












November 12-14, 2014

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Meeting planning committee

- Mark Cantrell, U.S. Fish and Wildlife Service - program co-chair
- Steve Fraley, N.C. Wildlife Resources Commission - program co-chair
- Andrea Leslie, N.C. Wildlife Resources Commission
- Bryn Tracy, N.C. Division of Water Resources
- David Gillette, University of North Carolina at Asheville
- Erin McCombs, American Rivers
- Gary Peeples, U.S. Fish and Wildlife Service
- Jake Schaffer, University of Southern Mississippi
- Mike Gangloff, Appalachian State University
- Tom Martin, Western Carolina University

About us

The Southeastern Fishes Council (SFC) is a nonprofit scientific organization dedicated to the study and conservation of freshwater and coastal fishes of the southeastern United States, home to the greatest global biodiversity of temperate freshwater fishes and well over one-half of all species found in North America.

Southeastern Fishes Council leadership

- Chair - Ginny Adams, University of Central Arkansas
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- Managing editor - David Neely, Tennessee Aquarium Conservation Institute
- Associate editor - Chris Skelton, Georgia College and State University
- Treasurer - Steven Rider, Alabama Division of Wildlife and Freshwater Fisheries

Meeting schedule

Wednesday, November 12, 2014

3:00 Registration table opens, speakers drop-off presentations. Table closes at 7:00
7:00 Informal gathering at Barley's Taproom, 42 Biltmore Avenue

Thursday, November 13, 2014

7:00 Registration opens, speakers drop-off presentations

PLENARY SESSION

8:00 Welcome, Mark Cantrell, U.S. Fish and Wildlife Service; and Steve Fraley, N.C. Wildlife Resources Commission - program co-chairs
8:15 Twenty-Five Years Of Conservation Aquaculture In The Southeast. What Have We Learned?
- *J.R. Shute*

9:00 Native Fish Conservation Areas: A Community Approach To Aquatic Conservation
- *Fred Harris*

9:20 Planning A Reintroduction With Emphasis On Genetic Considerations
- *Greg Moyer*

9:40 The Dirty Bird Flies Again: Partnership And Persistence Pay Off In The Pigeon
- *Steve Fraley and Joyce Coombs*

10:00 Break

SESSION I -- Re-introductions • *Ryan Heise, N.C. Wildlife Resources Commission, moderator*
(unless otherwise noted, the first author is the presenter)

10:20 Movement Ecology And Dispersal Patterns Of Reintroduced Lake Sturgeon In The Upper Tennessee River System
- *Christina Saidak, Mark Cantrell, and Larry Wilson*

10:40 Genetic Assessment Of The Lake Sturgeon Reintroduction Program In The Tennessee River
- *Ashantyé S. Williams and Gregory R. Moyer*

11:00 Removing A Stream From North Carolina's §303 (D) List – The Richland Creek Fish Re-Introduction Project
- *Bryn H. Tracy*

11:20 Movement Patterns Of Translocated Adult Sicklefin Redhorse (*Moxostoma* sp.) In The Oconaluftee River
- *Jessica Davis, Vanessa Hunter, David Gillette, C. Reed Rossell Jr., Michael LaVoie, and Mark Cantrell*

11:40 Chronicles Of Southern Appalachian Brook Trout Restoration In Tennessee: Past, Present And Future
- *Jason Henegar, Jim Habera, Kathlina Alford, Jim Herrig, David Teague, and Thomas Johnson*

12:00 Announcements
12:10 Lunch until 1:30

SESSION II – Communities • *Tom Martin, Western Carolina University, moderator*

1:30 Investigating The Role Of Parental Care In *Nocomis* Nest Association
- *Stephen Floyd*

1:50 Nest Association Drives Cyprinid Community Structure: Preliminary Evidence For The Stress-Gradient Hypothesis In Vertebrate Communities
- *Brandon K. Peoples and Emmanuel A. Frimpong*

2:10 Multi-Year Comparisons Of Fish Community Shifts In Response To Natural Gas Development On The Fayetteville Shale, Arkansas
- *Brittany V. Furtado, Jessie J. Green, Ginny Adams, and Reid Adams*

2:30 Water Availability As A Catalyst For Stream Fish Assemblage Shifts In Alabama
- *Warren Stiles and Carol Johnston*

2:50 Effects Of Landuse Change On Fish Assemblage Metrics In The Upper French Broad River Basin
- *David Gillette, Dylan Cipkowski, Nicole Dexter, and Jackie Langille*

3:10 Associatons Between Fish Assemblages And Agricultural Land Use In The Nolichucky River Watershed
- *Brian Alford, Joyce Coombs, and Justin Wolbert*

3:30 Expansion Pattern Of *Notropis texanus* (Weed Shiner) In The Tennessee River Drainage
- *Jeffery M. Ray, Joseph W. Schafer, and Amanda L. Oliger*

3:50 Break

4:00 Southeastern Fishes Council business meeting

POSTER SESSION

6:00 Poster Set-up

6:30 Evening social and poster reception

Friday, November 14, 2014

SESSION III – Species • *Brian Alford, University of Tennessee, Knoxville, moderator*

8:00 Status Of And Threats To The Laurel Dace, *Chrosomus saylori*, Endemic To Walden Ridge, Tennessee
- *Bernard R. Kuhajda, David A. Neely, Anna L. George, and Sarah C. Hazzard*

8:20 Substrate Characteristics And Potential Contaminant Exposure Risk Of Lake Sturgeon Habitat In The Upper Tennessee River
- *Daniel Walker, Mark Cantrell, Steve Alexander, and Brian Alford*

8:40 A Systematic Evaluation Of *Orconectes* Cf. *barrenensis* From The Red River System (Cumberland River) Of Tennessee And Kentucky
- *Erin Bloom, Rebecca Blanton Johansen, John Johansen, and Mollie Cashner*

9:00 Swimming Ability Of Larval And Juvenile Sicklefin Redhorse
- *Tomas J. Ivasauskas, Thomas J. Kwak, and Patrick L. Rakes*

9:20 Lake Waccamaw Endemics And The Arrival Of Invasive Species
- *Ryan J. Heise and Ed Corey*

9:40 Break

SESSION IV -- Genetics / Evolution • *Anna George, Tennessee Aquarium Conservation Institute, moderator*

10:00 Southern Sander: Evidence For A Cryptic Species Of Walleye In The Mobile Basin
- *Raymond Simpson, Thomas Near, and Steve Rider*

10:20 Revealing What Lies Beneath: Utilizing Environmental DNA (eDNA) To Detect Rare Fishes In Louisiana
- *Erica N. Rottmann and Kyle R. Piller*

10:40 The Influence Of Phylogeny On Minnow Morphology, Ecology, And Physiology
- *Edward D. Burress, Jordan M. Holcomb, and Jonathan W. Armbruster*

11:00 Comparison Of Historic And Contemporary Molecular Methods To Assess North Carolina's Brook Trout
- *Jacob Rash, Barbara Lubinski, and Tim King*

11:20 Population Structure Of Sicklefin Redhorse (*Moxostoma* sp.) In The Tuckasegee, Little Tennessee, And Hiwassee River Drainages
- *Sandra Bohn, Ashantyé S. Williams, and Gregory R. Moyer*

11:40 Population Genetic Patterns Of *Semotilus atromaculatus* Across Six Drainages In Mississippi And Arkansas
- *Bjorn Schmidt, Jake Schaefer, and Brian Kreiser*

12:00 Taxonomic Status Of The Snubnose Darters *Etheostoma simoterum* And *E. tennesseense*
- *Thomas J. Near, Ethan France, and Richard C. Harrington*

12:20 Lunch until 1:30

1:30 Announcements and student paper and poster awards • *Bryn Tracy, N.C. Division of Water Resources*

SESSION V – Management • *Brena Jones, N.C. Wildlife Resources Commission, moderator*

1:40 Using A Non-Governmental Organization As A Catalyst For Stream Habitat Enhancement On Private Lands
- *Jason Meador*

2:00 Bundling Fishes: What Can We Learn About Madtoms And Darters?
- *Andrew L. Sheldon, Melvin L. Warren, Jr., Wendell R. Haag*

2:20 The Efficacy Of Small-Scale Removal Of An Invasive Species (Redbreast Sunfish (*Lepomis auritus*)) By Electrofishing
- *Miranda Aiken, Thomas Martin, and Rachael Woods*

2:40 Dam Removal: A Guide To Effective Restoration And Prioritization
- *Erin McCombs*

3:00 A New Framework To Evaluate And Avert Risks To Fragmented Populations Of Stream Fish
- *James H. Roberts*

3:20 Break

SESSION VI – Habitats • *Thomas Russ, N.C. Wildlife Resources Commission, moderator*

3:40 Restoring Habitats And Recovering Species One Shu At A Time
- *Jeffrey R. Powell, Patrick E. O'Neil, and Paul D. Johnson*

4:00 Burrowing Site Selection By Juvenile *Cambarus diogenes*: The Role Of Chimneys And Herding
- *Mallary Clay, Jim Stoeckel, and Brian Helms*

4:20 Eel Ladders And Dam Passage Of Upstream Migrant American Eels In The Shenandoah River Drainage
- *Stuart A. Welsh and Joni. L. Aldinger*

4:40 Fish Community Monitoring Associated With The Removal Of The Dillsboro Dam, Tuckasegee River, North Carolina
- *David J. Coughlan, Barry K. Baker, D. Hugh Barwick, and Gene E. Vaughan*

5:00 Safe travels!

Posters

(alphabetical by title)

Captive Propagation And Reintroduction Of The Kentucky Arrow Darter, *Etheostoma spilotum*, In The Upper Kentucky River Drainage, Clay County, Kentucky
- *Matthew R. Thomas, Stephanie L. Brandt, Patrick L. Rakes, J.R. Shute, Crystal L. Ruble, Melissa A. Petty*

Changes In Land Use And Fish Assemblages In Sylamore Creek Over A Thirty-Nine Year Period
- *Heather Allaben Saco, Ginny Adams, Reid Adams*

Conservation And Habitat Use Of Coastal Plain Madtoms
- *Shawn Patrick Settle and Rebecca Blanton Johansen*

Conservation Status Of The Egg-Mimic Darter (*Etheostoma pseudovulatum*)
- *Zachary Wolf and Rebecca Blanton Johansen*

Detection Of Rare Aquatic Species: Using Environmental DNA To Locate Populations Of Alabama And Gulf Sturgeon
- *Alexis M. Janosik, Carol E. Johnston, Steven J. Rider*

Development And Testing Of Sampling Techniques For Monitoring Sicklefin Redhorse (Undescribed *Moxostoma*) In Brasstown Creek, Georgia
- *Austin Farley, William Leatherwood, and Johnathan Davis*

Genetic And Morphological Diversity In The Imperiled Striated Darter *Etheostoma striatulum*
- *Thomas J. Near*

Geometric Morphometrics Of The Broadstripe Shiner, *Pteronotropis euryzonus* (Suttkus, 1955), And Other Members Of *Pteronotropis* In The Southeast
- *Malorie M. Hayes, Brendan J. Gould, Jonathan W. Armbruster*

Influence Of Land Use And Stream Physicochemical Habitat On New River Fish Communities
- *Gary Pandolfi, Jason Selong, M. Worth Pugh, Thomas Franklin, Daniel Mason and Michael M. Gangloff*

Life-History Aspects Of *Chrosomus oreas*, Mountain Redbelly Dace, In Catawba Creek, Virginia
- *Shelby Hargrave, Gregory Morgan, and Steven L. Powers (presenter)*

Long-Term Spotfin Chub Monitoring In The Little Tennessee River, North Carolina: Overview And Results For Eight Years
- *T.R. Russ and Steve Fraley*

Preliminary Data For Diagnosing Putative Lineages Of The Southern Cavefish (*Typhlichthys subterraneus*) In Alabama
- *Pamela Hart, Jonathan Armbruster*

Preliminary Ecological Endpoint Curves For The Cumberland Plateau Of Alabama
- *David C. Werneke, Eric F. Bauer, Jason M. Zink, Eve F. Brantley, Greg D. Jennings, and Brian S. Helms*

Quantitative Microscopic Analysis Of Darter (Percidae: Etheostomatinae) Scale Morphology
- *Courtney Weyand, Zachary Holtel, Eva Grebe, Sarah Lundin-Schiller and Rebecca Blanton Johansen*

Restoration And Revitalization The Arkansas State University Museum Of Zoology Ichthyology Collection
- *Starlene M. Loerch, John L. Harris, Tracy Klotz, and Brook L. Fluker*

Seeking Taxonomic Resolution: Is *Orconectes Cf. barrenensis* From The Red River (Cumberland River) Of Tennessee A Distinct Species Of Crayfish?
- *Brittany McCall, Erin Bloom, Rebecca Blanton Johansen, and John Johansen*

Traditional Sampling Detection vs. Environmental DNA Detection
- *Mariah O. Pfleger, Carol E. Johnston, Steven J. Rider, Alexis M. Janosik*

Abstracts

(alphabetical by last name of presenter)

Aiken, Miranda , Thomas Martin, and Rachael Wood. Western Carolina University.

The Efficacy Of Small-Scale Removal Of An Invasive Species (Redbreast Sunfish (*Lepomis auritus)) By Electrofishing

Invasive species are a common nuisance to native species in aquatic habitats and controlling their spread is necessary to improve native populations. The response of the Redbreast sunfish (*Lepomis auritus)* population in Richland Creek, Haywood County, NC, was evaluated to determine if removing them via electrofishing was an effective method for selective removal of this invasive species and to determine if native Rock bass would re-establish in the removal areas. The fish were removed from three study sites using standard backpack electrofishing techniques. The Redbreast sunfish from the experimental reaches were euthanized and the fish from paired control reaches were marked and released back into the stream. The length and weight of all Redbreast sunfish and Rock bass caught were measured. Population size was estimated by the 3-pass removal method. The results indicate that the population responded to the removal and was significantly decreased. While the population of Redbreast sunfish in Richland Creek was reduced by electrofishing, fin-clipped fish from control reaches were occasionally captured suggesting upstream-downstream movement. Given that a small reservoir downstream (Lake Junaluska) may serve as a source population, there would need to be a continued effort in order to control the population. I was unable to detect a response of Rock bass by the removal of Redbreast sunfish due to the extremely low capture success.

Alford, Brian, Joyce Coombs, Justin Wolbert. The University of Tennessee, Department of Forestry, Wildlife, and Fisheries.

Associations Between Fish Assemblages And Agricultural Land Use In The Nolichucky River Watershed

The Nolichucky River watershed in east Tennessee is one of the most critically important "hot spots" for North American biodiversity. However, agricultural land use has intensified during the last decade with vegetable "truck crops", primarily tomatoes, flourishing in the region. Pesticide treatments during the warm growing season have caused runoff-related fish kills. The goal of our study is to explore relationships between agricultural landscapes and the structure of fish assemblage and biotic integrity in the watershed. During July-October 2014, we surveyed 9 sites (5 tributaries, 6 main stem) using Tennessee Valley Authority (TVA) sampling protocols, specifically backpack electrofishing at riffle-run habitats and seine hauls in pools. Fish sampling and water quality assessments were conducted at sites we considered to be least impacted (n=3), moderately impacted (n=3), and most impacted (n=3) by agricultural fields. Thus far, 39 species (4,612) have been documented from 174 riffle-run habitats, while 38 species (1,082 individuals) were sampled from 94 pools. Cluster analysis and PerMANOVA revealed that fish assemblages were statistically different and were grouped based on our site impairment classification. Results of indicator species analysis (ISA) suggested that, for riffle-run habitats, *Nothonotus acuticeps*, *Nothonotus camurum*, and *Notropis rubricroceus*, were indicators of the least impacted condition. For moderately impacted sites, *Nocomis micropogon* and *Notropis volucellus* were adequate indicators species. Meanwhile, species indicative of heavily impacted sites were *Nothonotus rufilineatus* and *Cottus carolinae*. For pool habitats, least impacted indicator species included *Notropis telescopus* and *Notropis micropteryx*, while *Moxostoma breviceps* was an indicator of moderately impacted sites. Species indicators of most impacted sites included *Luxilus coccogenis* and *Notropis photogenis*. We continue to assess impacts of agricultural landscapes on health and condition of aquatic biota, including benthic macroinvertebrate assemblages and fish physiology (e.g., intersex condition, parasite load, sensory system development).

Bloom[1], Erin, Rebecca Blanton Johansen[1], John Johansen[1,2], and Mollie Cashner[1]. [1]Austin Peay State University, Center of Excellence for Field Biology and Department of Biology, Clarksville, TN 37040 [2]Tennessee Technological University, Department of Environmental Sciences, Cookeville, TN 38505.

A Systematic Evaluation Of *Orconectes* Cf. *barrenensis* From The Red River System (Cumberland River) Of Tennessee And Kentucky

Orconectes barrenensis is endemic to the Green River system of KY and TN. The closely related species, *Orconectes mirus*, is restricted to Tennessee River tributaries in TN and AL. Neither species has been reported from the Red River (Cumberland River); however, there have been multiple reports of a crayfish from the Red River that is morphologically similar to *O. barrenensis* and *O. mirus* that has been referred to as *O. cf. barrenensis*. The objectives of this work were to use molecular data to resolve the phylogenetic relationships and taxonomic status of *O. cf. barrenensis*. Tissues and specimens representing all

known localities of *O. cf. barrenensis*, and a subset of those for *O. barrenensis* and *O. mirus* were collected or borrowed from institutions. Previously published primers were used to amplify and sequence two mitochondrial genes (COI and 16s) and two nuclear markers (28s and GAPDH), for the focal taxa. Additional COI sequences of other *Orconectes* and outgroup taxa were obtained from GenBank. Individual genes and a concatenated data set including all genes were used to generate hypotheses of relationships with Maximum Parsimony and Bayesian inference methods. Genetic results support the morphology-based assumption of a close relationship among *O. cf. barrenensis, O. barrenensis* and *O. mirus*, which were recovered as a well supported clade. Within this clade, *O. cf. barrenensis* was monophyletic and divergent from *O. barrenensis* and *O. mirus*. However, relationships among the *O. cf. barrenensis* clade and these other taxa were unresolved, and neither *O. barrenensis* nor *O. mirus* were monophyletic, suggesting potentially unrecognized diversity in these species.

Bohn[1,2], Sandra, Ashantyé S. Williams[1], and Gregory R. Moyer[1]. [1]U.S Fish and Wildlife Service, Conservation Genetics Laboratory; [2]Auburn University.

Population Structure Of Sicklefin Redhorse (*Moxostoma* sp.) In The Tuckasegee, Little Tennessee, And Hiwassee River Drainages

The Sicklefin redhorse (*Moxostoma sp*.) is an imperiled species endemic to the Tuckasegee, Little Tennessee, and Hiwassee River drainages of Georgia and North Carolina. While still undescribed, it is believed that the Sicklefin redhorse inhabited a larger range within these drainages than observed today; therefore, restoration and reintroduction efforts to expand the Sicklefin's current range are ongoing. In an effort to minimize genetic risks associated with hatchery-based reintroduction efforts, we estimated genetic diversity within and among samples collected from the known range of the species. To this end, 382 individuals were sampled from the three drainages and genotyped for ten microsatellite loci. Samples collected from each drainage were genetically distinct; although, there was evidence that individuals are straying between the Tuckasegee and Little Tennessee populations. The Hiwassee population had the lowest genetic diversity of the three populations, with a lower effective population size, lower expected heterozygosity, and lower allelic richness. The Tuckasegee and Little Tennessee populations had similar levels of genetic diversity for all three measures. Future restoration efforts should attempt to preserve the three genetically distinct populations while attempting to expand the range of Sicklefin redhorse within these drainages. Efforts (e.g., habitat restoration) should also be made to retain the remaining genetic diversity within the Hiwassee population.

Burress [1], Edward D., Jordan M. Holcomb [2], Jonathan W. Armbruster [1]. [1]Department of Biological Sciences and the Auburn University Museum of Natural History,Auburn University, [2]Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission.

The Influence Of Phylogeny On Minnow Morphology, Ecology, And Physiology

Species' functional roles are a complex interaction between morphology, ecology, and physiology. Morphology acts as a constraint on resource use. Physiology, coupled with environmental conditions such as nutrient availability, may affect how species recycle nutrients. Additionally, morphology, ecology, and physiology may be constrained by phylogeny. Here, we investigate the functional roles of 15 sympatric minnows in the New River (Watauga Co., North Carolina) using geometric morphometrics, gut content analysis, and stable isotope analysis. Additionally, we test the influence of phylogeny on the species-ecosystem function linkage via constraint of morphology, ecology, and physiology. Morphological variation among minnows was explained primarily by jaw orientation. Minnow diet exhibited a continuum between utilization of benthic and pelagic resources. There were large discrepancies between consumption and assimilation, with most species assimilating exclusively insects regardless of the degree of omnivory. Morphological, ecological, and physiological traits exhibited phylogenetic signal, suggesting that phylogeny strongly constrains the species-ecosystem function linkage.

Clay[1], Mallary, Jim Stoeckel[2], and Brian Helms[3]. [1]Department of Biology, Catawba College, Salisbury, NC; [2]School of Fisheries, Aquaculture, and Aquatic Sciences, Auburn University, Auburn, AL; [3]Department of Biological Sciences, Auburn University, Auburn, AL.

Burrowing Site Selection By Juvenile *Cambarus diogenes*: The Role Of Chimneys And Herding

Burrowing crayfish can serve as an ecological link between aquatic and terrestrial environments, however little is known about their natural history. The Devil crayfish (*Cambarus diogenes*) is a widely distributed burrowing crayfish and a potential model organism for understanding the natural history of this group in general. *C. diogenes* often occur in dense colonies in floodplain forests, however females release juveniles in open water and these juveniles ultimately migrate to the floodplain as adults. Potential cues that juveniles may use to locate adult colonies include herding behaviors and chimneys associated with existing adult burrows. To test whether juveniles use each other as visual cues for where to burrow, 10

mesocosms were filled with type-locality soil, six juveniles were released in the center of each and their burrowing behavior tracked. To test the role of chimneys as burrowing cues, 10 mesocosms were filled with type-locality soil and then divided into 3 sections with the middle of each section containing a chimney created by either *C. diogenes, C. striatus*, or humans. Juveniles showed a significant clumping behavior, with the number of burrows in the mesocosm sections being distributed significantly different than expected from random. Also, the number of juveniles burrowing in the mesocosm sections containing a conspecific adult chimney was significantly different than the congeneric and human-built chimneys. These results suggest that the juveniles use each other as well as species-specific adult chimneys as cues for burrowing site selection. Migrating to the floodplains in groups potentially increases juvenile survival, while inhabiting close proximity to the same species could increase the chance of reproduction; both increase the organism's fitness.

Coughlan[1,2], David J., Barry K. Baker[1], D. Hugh Barwick[1], and Gene E. Vaughan[1]. [1]Duke Energy (retired) [2]Normandeau Associates.

Fish Community Monitoring Associated With The Removal Of The Dillsboro Dam, Tuckasegee River, North Carolina

Removal of the Dillsboro Dam on the Tuckasegee River, NC, was a key component in stakeholder settlement agreements associated with the relicensing of Duke Energy's Nantahala area hydroelectric projects. Regulatory requirements for dam removal mandated fish collections (May and October) at four Tuckasegee River sampling locations (Downstream, Tailrace, Reservoir, and Upstream) prior to removal (2008) and three years following removal (2010 - 2012). Species richness was always highest in the Tailrace and lowest in the Reservoir (and its successor) immediately upstream of the Dam. Observed fish community metrics in 2008 indicated the fish assemblage in the Reservoir, dominated by Rock bass and Redbreast sunfish, was more consistent with the lentic habitat characterizing that site. Meanwhile, the communities at the other three riverine locations (Downstream, Tailrace, and Upstream) were always dominated by cyprinids. Pollution tolerance data indicated the Reservoir fish community had the highest percentage of individuals tolerant of pollution (Redbreast sunfish) and the lowest number of species considered intolerant of pollution. Trophic data (combined percentage of omnivores and herbivores or percentage of insectivores) similarly indicated the fish community in the Reservoir was atypical, though these differences decreased after dam removal. Dam removal in early 2010 resulted in the immediate reduction of a large portion of the lentic habitat in the Reservoir, though a submerged rock ledge produced persisting pool habitat. The pre-dam removal fish community in the Reservoir shifted in less than one year to a community dominated by cyprinids. Mottled sculpin and darters were not collected in the former Reservoir until 2012. Removal of this fish migration barrier in Dillsboro, NC, provided significant benefits (i.e., restoration of upstream access for species of interest like Sicklefin redhorse and Olive darter) for the Tuckasegee River fish community.

Davis[1], Jessica, Vanessa Hunter[1], David Gillette[1], C. Reed Rossell Jr.[1], Michael LaVoie[2], Mark Cantrell[3]. [1]University of North Carolina Asheville, Department of Environmental Studies [2]Eastern Band of Cherokee Indians [3]US Fish and Wildlife Service, Asheville Field Office.

Movement Patterns Of Translocated Adult Sicklefin Redhorse (*Moxostoma sp.*) In The Oconaluftee River

The Sicklefin redhorse (SFRH) is a medium-sized sucker in the genus *Moxostoma*. Like many other suckers of the southern United States, the SFRH population is at risk due to habitat degradation, river and stream impoundments, eutrophication, siltation, and invasive exotic species. The objectives of this study were to determine the effect of release site and individual variation on distance moved and home range size for adults that have been relocated into a river that is historically within its home range, but from which they have since been extirpated. On August 26, 10 native SFRH were collected from the Tuckasegee river in Swain County, NC, surgically implanted with radio transmitters and passive integrative transponder tags and relocated into the Oconaluftee River upstream from Ela Dam. We tracked individual fish weekly using radio telemetry to determine movement patterns. Data on distance moved and home range will be presented.

Farley, Austin William Leatherwood, and Johnathan Davis. Young Harris College, Department of Biology.

Development And Testing Of Sampling Techniques For Monitoring Sicklefin Redhorse (Undescribed *Moxostoma*) In Brasstown Creek, Georgia

The Sicklefin redhorse (SFR), *Moxostoma sp*. is an undescribed, candidate species occurring in north Georgia within Brasstown Creek in the Hiwassee River watershed. Records and sampling of the SFR in the watershed are sparse and infrequent with dedicated monitoring limited to 1-2 days annually. This project surveyed the population within Georgia and determined sampling techniques for use in future SFR monitoring. Representative 100-meter reaches along Brasstown Creek (n=12) were sampled in spring 2013 and 2014 using three sampling techniques (e.g. visual surveys, seining, and snorkeling) to determine the method that most likely detects SFR presence. Seining methods performed poorly in detecting

Sicklefin redhorse presence (4%) in 2013, but implementation of block nets in the 2014 sampling protocol increased seine detections (29%) as well as for other methods such as streamside visual survey detections (57%). Streamside visual surveys were most effective for detecting SFR presence. Additionally, SFR were detected in Georgia from mid-April to late May at water temperatures of 12-18°C. New records for SFR were documented at stream crossings at Brasstown Creek Road and Townsend Mill Road. Other redhorses were observed upstream of GA 515 (Hwy 76), and SFR presence upstream of this location should be investigated. SFR detections were correlated with run habitats and small boulder substrates. Although visual survey methods are effective for detecting SFR, these surveys are not useful for collecting fisheries data such as length, weight, sex and aging structures. SFR capture in seines is possible but difficult, with females likely being undersampled. Additional work included removing fin clips for genetic analysis and tagging SFR for telemetry purposes. Future work includes continued annual monitoring, delineating spawning sites and habitat preferences, telemetry study, and assessment of annual variation in growth among year-classes.

Floyd, Stephen. Virginia Polytechnic Institute, Department of Fish and Wildlife Conservation.

Investigating The Role Of Parental Care In *Nocomis* Nest Association

Nocomis nest association is common throughout the eastern United States, but the mechanisms by which hosts and associates benefit are largely unstudied. Past work has shown that associates will not spawn on unguarded artificial nests, leading to the hypothesis that host-provided parental care (nest guarding and egg burying) is the primary beneficial mechanism. Understanding the relative risk of spawning on guarded/unguarded nests vs. open substrate can provide insight into the benefits of nest association vs. broadcast spawning. Spatial position of eggs can influence survival. Hosts and associates deposit eggs in a spawning trough on the upstream ends of nests. Eggs become buried as gravel is deposited over the eggs. If buried eggs experience lower predation rates than eggs located near the surface, more eggs should be found in lower upstream portions of nests. We compared predation rates on eggs glued to stones and placed just below the surface on ten pairs of open substrate, artificial and guarded nests. Egg survival on guarded nests did not differ from other locations ($p=0.759$), probably because eggs were placed near the surface and eaten. We divided eight nests vertically and laterally and compared egg counts between the four sections. General linear models with nests as block effects revealed that division was a significant predictor ($p=0.001$), with bottom-upstream sections containing significantly more eggs than the other three sections. We then glued eggs to stones and buried one in the nest and placed one near the surface of the spawning trough. A paired t-test corroborated that buried eggs had significantly higher survival than eggs near the surface ($p=0.001$). These results suggest that egg burying, not combative predator prevention, is the parental care mechanism by which associates benefit. Without egg burying, spawning on *Nocomis* nests may be just as risky for associates as open substrate spawning.

Fraley[1], Steve and Joyce Coombs[2]. [1]NC Wildlife Resources Commission, Aquatic Wildlife Diversity, [2]University of Tennessee, Forestry, Wildlife, & Fisheries.

The Dirty Bird Flies Again: Partnership And Persistence Pay Off In The Pigeon

For over a decade, the interstate and inter-organizational partnership known as the Pigeon River Recovery Project (PRRP) has been actively working to restore native species to the recovering Pigeon River system in Tennessee and North Carolina. For over 90 years, severe pollution flowed virtually untreated into the Pigeon from a large paper mill at Canton, NC. After decades of legal wrangling, an agreement among TN, NC, and the USEPA was finally reached in 1998 that put the Pigeon River on the road to recovery. Since 2001, partners from federal and state agencies, academia, industry, and private organizations have cooperated to translocate and release more than 37,000 fishes (20 species), 225,000 snails (six species), and 4700 mussels (11 species) into target reaches in TN and NC. Survival and reproduction is documented for 18 species in both reaches combined. Gilt darter (*Percina evides*) and Silver shiner (*Notropis photogenis*) were the first translocated species in each reach to show evidence of recruitment and dispersal. To date, eight fish species have become reestablished in good numbers and age distributions over significant reaches (up to 20 stream miles) of the mainstem Pigeon and/or direct tributaries. Mollusks have also been a focus of re-introduction, beginning with a pilot study that placed native snails in the Tennessee reach in 1999 and culminating to date with the release of captively propagated Wavy-rayed lampmussels (*Lampsilis fasciola*) in the North Carolina reach, and translocations of 10 additional species to the Tennessee reach. Survival and growth have been documented and prospects appear hopeful for some level of recovery of mollusk communities. Efforts continue, but opportunities are more limited as we approach the current potential for restoration in this dynamic, improving, but still impacted system.

Furtado, Brittany V., Jessie J. Green , Ginny Adams , and Reid Adams. University of Central Arkansas.

Multi-Year Comparisons Of Fish Community Shifts In Response To Natural Gas Development On The Fayetteville Shale, Arkansas

Natural gas has been popularized globally as a "bridge" fuel to renewable energy sources and is expected to account for 26% of the total U.S. energy use by 2035, second only to petroleum. Although research on the impact of hydraulic fracturing and horizontal drilling is steadily increasing, there is still a paucity of data concerning biotic responses to natural gas extraction from unconventional sources. The Fayetteville Shale has seen exponential natural gas development (NGD) in the last ten years and currently has over 5,000 active wells. We sampled 13 sites across the Fayetteville Shale in north central Arkansas annually in the spring for three years (2012-2014). Fishes were quantitatively sampled using backpack electrofishing and multi-pass depletion techniques. Pairwise correlations were used to examine a suite of community response metrics that included different functional and feeding groups (e.g. percent invertivores, simple lithophilic spawners, etc.) in relation to increasing NGD. Partial correlations were used to examine the relationship between the community response metrics and NGD when % pasture, the only other significant land use variable, was held constant. Results from 2012 and 2013 indicate persisting disturbance strongly linked to NGD. However, while trends from previous sampling years persisted in 2014, the strength of the correlations was diminished. Variation in precipitation and stream discharge, as well as a gradual shift in NGD-related activities from construction and drilling to maintenance and extraction may have played a significant role in the fish community response.

Gillette, David, Dylan Cipkowski, Nicole Dexter, Jackie Langille. University of North Carolina Asheville, Department of Environmental Studies.

Effects Of Landuse Change On Fish Assemblage Metrics In The Upper French Broad River Basin

Changes in landuse can have strong effects on abundance and distribution of fishes. Because fishes are sensitive to environmental degradation, fish assemblage-based metrics are often used as indicators of stream habitat quality. In this study, we examined effects of landuse change over a 15-year period on fish assemblage-based metrics of habitat quality in the Upper French Broad River basin in western North Carolina. This region contains areas that have undergone a large amount of landuse change during this time period, as well as areas that have remained relatively unchanged, making it an ideal setting for such a study. Impacts of landuse change on three different spatial scales (entire watershed, entire watershed riparian zone, and upstream 1 km riparian zone) will be discussed.

Hargrave, Shelby, Gregory Morgan, and Steven L. Powers. Roanoke College, Biology Department.

Life-History Aspects Of *Chrosomus oreas*, Mountain Redbelly Dace, In Catawba Creek, Virginia

Chrosomus oreas, Mountain Redbelly dace, is a conspicuous and abundant species in headwater streams in Virginia, West Virginia, and North Carolina, but much of its life-history is unknown. We collected and examined a total of 256 specimens during monthly collections from Catawba Creek in Roanoke County, Virginia between November 2009 and October 2010 to discover previously unknown aspects of the life-history of this species. Maximum size of specimens examined was 64.68 mm standard length and 5.574 g total weight. Maximum age was 29 months and sexual maturity is not reached until approximately 2 years of age. Gonadosomatic Index increased in April and peaked in June corroborating previous reports of spawning season. Gravid females had 128-610 mature oocytes (mean = 334, sd = 174.5) up to 1.59 mm in diameter. Sex ratio was not significantly different from 1:1 ($p = 0.237$). Of the gastrointestinal tracts examined, 46.5% were empty, 53.5% contained unidentified organic matter, and 0.4% contained unidentified insect parts consisted with previously reported gut contents. Mass of gut contents peaked in May and was lowest in August.

Harris, Fred. NC Wildlife Federation.

Native Fish Conservation Areas: A Community Approach To Aquatic Conservation

Although substantial environmental legislation in the previous century including the Clean Water Act, Clean Air Act, Endangered Species Act and the Wilderness Act had substantial positive effects on the conservation of aquatic resources, the diversity of native freshwater biota in North America continues to decline. One reason identified for the decline is a lack of focus on conserving biological communities at a watershed scale. Native Fish Conservation Areas (NFCAs) represent a management strategy to maintain and enhance the diversity and sustainability of native fish communities. Critical elements of a NFCA include a geographical area that actually or potentially is adequate to maintain the processes that create habitat diversity, complexity and connectivity; support the life history stages of species comprised by the aquatic community and provide long-term persistence of native fish populations. The Little Tennessee River in Georgia, North Carolina and Tennessee is the first water body in the United States to be managed as a NFCA. We have established a broad

partnership of agencies, organizations and institutions that are focused on conserving the native biota in this system using a collaborative, largely non-regulatory management approach.

Hart, Pamela, Jonathan Armbruster. Auburn University.

Preliminary Data For Diagnosing Putative Lineages Of The Southern Cavefish (*Typhlichthys subterraneus*) In Alabama

The Southern cavefish, *Typhlichthys subterraneus*, is the most widespread North American cavefish. Rarity and a lack of the normal characters used to distinguish species create problems for taxonomists when studying this group. Previous investigations (Niemiller *et al.* 2012) suggest that *T. subterraneus* represents a species complex. We used landmark-based geometric morphometrics and Principal Component Analysis to describe biologically meaningful variation in body shape between lineages of the southern cavefish in Alabama.

Hayes, Malorie M., Brendan J. Gould, Jonathan W. Armbruster. Auburn University, Department of Biological Sciences.

Geometric Morphometrics Of The Broadstripe Shiner, *Pteronotropis euryzonus* (Suttkus, 1955), And Other Members Of *Pteronotropis* In The Southeast

The Broadstripe shiner, *Pteronotropis euryzonus* (Suttkus, 1955), is a freshwater fish endemic to tributaries of the middle Chattahoochee River of Alabama and Georgia. Morphological and genetic studies have suggested the presence of at least two distinct forms of *P. euryzonus* in the Chattahoochee drainage. In this study, we use Geometric Morphometrics to examine the body-shape variation present within *P. euryzonus*. Principal Component Analyses were first performed on specimens of *P. euryzonus* as a single entity. Then, using genetic data as *a priori* hypothesis, a Canonical Variance Analysis was performed to describe the body shape variation present within three separate populations. Geometric Morphometics confirm the presence of distinct forms of *P. euryzonus* across populations. The body-shape variation within the species is then compared to other species of *Pteronotropis* which occur in river systems across the southeast. We specifically focus on the similarities and differences between *P. euryzonus* and its downstream ecological replacement *P. grandipinnis*.

Heise[1], Ryan J., and Ed Corey[2]. [1]North Carolina Wildlife Resources Commission, [2] North Carolina Division of Parks and Recreation.

Lake Waccamaw Endemics And The Arrival Of Invasive Species

Lake Waccamaw is a 9,000-acre bay lake located in North Carolina that is unique because of its water chemistry (near-neutral pH), large size, and endemic fauna. Fourteen species of rare fish and mussels have been documented from the lake. The North Carolina Wildlife Resources Commission and NC Division of Parks and Recreation have been conducting annual fish surveys and biennial mussel surveys at multiple locations in Lake Waccamaw. The catch-per-unit effort data for Waccamaw Silversides, Killifish, and Darters collected since 2009 suggest that abundant populations still persist. Unfortunately, three invasive species have now been documented in the lake. In October 2012, monoecious Hydrilla (*Hydrilla verticillata*) was discovered in the northwestern section of the lake in an area roughly 600 acres, while native vegetation occupied 3,600 acres. A technical advisory committee (comprised of numerous stakeholders) decided that a chemical treatment (Fluridone) was more appropriate than triploid grass carp for control. In 2013, thirty-two acres of Black Mat Algae, *Lyngbya wollei*, was documented within the area already infested with Hydrilla. This filamentous cyanobacterium can become invasive and is difficult to treat and options with the least risk are being discussed. In June 2014, we collected a large Flathead Catfish (*Pylodictis olivaris*) from near the WRC boating access area. This is this first official record of this species in the lake, although anecdotal accounts have existed for several years. The illegal stocking of this predatory catfish will negatively affect sunfish populations and possibly other fishes of Lake Waccamaw. Outreach programs are underway at Lake Waccamaw State Park and informational signs have been posted at boat ramps and other high-visibility locations around the lake. We will continue our long-term monitoring surveys of the fish and mollusks to ensure that populations remain viable and to help refine our management strategies.

Henegar[1], Jason, Jim Habera [1] Kathlina Alford [2] Jim Herrig [3] David Teague [4] Thomas Johnson [5]. [1]Tennessee Wildlife Resources Agency [2] Tennessee Aquarium Conservation Institute [3] U.S. Forest Service [4] U.S. Fish & Wildlife Service [5] Tennessee Technological University.

Chronicles Of Southern Appalachian Brook Trout Restoration In Tennessee: Past, Present And Future

While Brook trout (*Salvelinus fontinalis*) are distributed broadly across eastern North America, southern Appalachian Brook trout (SABT) in Tennessee and North Carolina are considered genetically distinct from northern populations. Historically, poor logging and agricultural practices, as well as introduced populations of Rainbow trout, Brown trout, and even northern Brook trout have reduced the range of SABT. Restoration and translocation projects with SABT have been conducted in the state since the early 1990's. Based on recent surveys conducted by TWRA, brook trout occupy only 23% (229 km) of their historic range in Tennessee, while unhybridized SABT populations occur in only about 13%. Moving forward, a newly - developed captive propagation program for SABT could provide the fish needed for reestablishment or enhancement projects with a much lower impact on existing wild populations. TWRA's Tellico Hatchery has successfully produced SABT several times over the past decade using a traditional flow- through hatchery system and fish from Sycamore Creek. In 2013, the Tennessee Aquarium Conservation Institute (TNACI) began propagating SABT using fish from Hampton Creek in a recirculation aquaculture system. Following these successes, a joint research endeavor between TWRA, TNACI, US Forest Service, US Fish & Wildlife Service and Tennessee Technological University (TTU) was launched to determine the best culture methods for these fish and determine the viability of this method as a restoration tool. TWRA's Tellico and Erwin hatcheries, along with TNACI, will raise fish from both populations and a comparison of fish culture methodology and survival rates after release will be conducted by TTU. Using data from range surveys and results from propagation research, the working group will be able to identify streams with the greatest restoration potential, appropriate source populations and best production practices for Tennessee's only truly native salmonid.

Ivasauskas[1], Tomas J., Thomas J. Kwak[2] Patrick L. Rakes[3]. [1]North Carolina Cooperative Fish and Wildlife Research Unit, Department of Applied Ecology, [2]U.S. Geological Survey, North Carolina Cooperative Fish and Wildlife Research Unit, Department of Applied Ecology, North Carolina State University [3]Conservation Fisheries, Inc.

Swimming Ability Of Larval And Juvenile Sicklefin Redhorse

Effective management of rare or endangered fish species is dependent on a thorough understanding of ontogeny, ecology, and habitat requirements at all life stages. Swimming ability is important in determining patterns of larval and juvenile fish dispersal, distribution, and nursery habitat selection, which may guide critical habitat protection. The Sicklefin redhorse *Moxostoma* sp. is a sucker (family Catostomidae) that is geographically restricted to the southern Appalachian Mountains and is of particularly high conservation concern. We designed a laboratory experiment to determine swimming ability of larval and juvenile Sicklefin redhorse. Sustained swimming abilities were assessed by subjecting captive-reared Sicklefin redhorse (N=102) to fixed-velocity swim trials, wherein fish were subjected to a prescribed water velocity until they became exhausted and unable to maintain position. Trials were performed in a 38-mm-diameter swim chamber capable of producing accurate velocities 0.05 – 0.25 m/s. Fish were subjected to trials approximately 1, 2, 4, 6, and 10 weeks after they exhibited swim-up behavior; mean total lengths were 16.0, 16.1, 20.3, 26.3, and 33.3 mm, respectively. Development classifications included early- and late-stage mesolarva, metalarva, and juvenile. Within each developmental class of fish, there was a significant negative relationship between water velocity and swimming duration ($P < 0.05$). Swimming ability increased monotonically among classes; sustained swimming speeds (30-min) increased from 0.099 m/s to 0.166 m/s across the range of sizes observed. Our estimates indicate that Sicklefin redhorse larvae exhibit marginally better swimming ability than similarly sized Robust redhorse *Moxostoma robustum*. The information gained from our findings will be used to develop a more thorough mechanistic understanding of habitat associations observed in concurrent field research and to guide planning and implementation of conservation and recovery efforts.

Janosik[1], Alexis M., Carol E. Johnston[2], Steven J. Rider[3]. [1]University of West Florida, Department of Biology, [2] Auburn University, Department of Fisheries, [3]Alabama Division of Wildlife and Freshwater Fisheries.

Detection Of Rare Aquatic Species: Using Environmental DNA To Locate Populations Of Alabama And Gulf Sturgeon

Environmental DNA (eDNA), is a relatively new technique that has proven to be a successful tool in the detection of rare and/or spatially and temporally variable organisms. For aquatic species, field sampling can require extensive effort and may be unreliable in terms of determining the presence or absence of a target species, especially when the target species is rare. For this study we used eDNA to detect populations of Alabama sturgeon (*Scaphirhynchus suttkusi*) and Gulf sturgeon (*Acipenser oxyrinchus desotoi*) in the Alabama, Cahaba, and Tombigbeerivers. These two species of sturgeon make ideal model organisms for examination of this technique in the detection of rare species, as the Alabama sturgeon is critically endangered and the Gulf sturgeon is listed as vulnerable on the International Union for Conservation of Nature (IUCN) red list. Results have revealed positive detections of Gulf sturgeon in all three major river systems; however, no detections for Alabama sturgeon

were observed. Successful detection of these species could reveal vital information such as understanding of habitat use for management purposes as well as identify specific localities for field sampling.

Kuhajda, Bernard R., David A. Neely, Anna L. George, Sarah C. Hazzard. Tennessee Aquarium Conservation Institute.

Status Of And Threats To The Laurel Dace, *Chrosomus saylori*, Endemic To Walden Ridge, Tennessee

The Laurel dace, *Chrosomus saylori*, is a federally endangered species endemic to small headwater streams along Walden Ridge in Bledsoe, Cumberland, and Rhea counties, Tennessee. It is historically known from only eight streams in the Soddy (1), Sale (3), Piney (3), and Grassy Cove (1) creek systems within the Tennessee River drainage. Preliminary genetic data suggests two genetically distinct groups, a southern population (Soddy and Sale Creek systems) and a northern population (Piney Creek system); Grassy Cove Creek genetics are unknown. Three populations are likely extirpated (Laurel Branch, Cupp Creek, and Grassy Cove Creek) and Laurel Dace have not been observed in the Soddy Creek system since 2004. All known localities were sampled in 2013 and 2014 to assess population persistence and site occupancy. Current distribution of possibly introduced Tennessee dace, *Chrosomus tennesseensis*, in the Piney Creek system was also assessed during survey work because this closely related congener could compromise the viability of northern populations of Laurel dace. Results indicate that the southern population of Laurel dace is restricted to a single pool in Horn Branch, with heavy siltation and poor water quality from agriculture (tomatoes) the likely cause of extirpation in other creeks. The northern population of Laurel dace (Piney Creek system) appears to be in relatively good shape, with high numbers of individuals in Bumbee and Moccasin creeks, but siltation and instream modifications for road crossings restrict distribution. The third creek in this system, Youngs Creek, has few Laurel dace and is impacted by heavy siltation and poor water quality from agriculture (tomatoes). Tennessee dace are abundant in Duskin Creek, which is located downstream of Laurel dace populations, but to date have not been observed in the Piney Creek mainstem upstream of Duskin Creek.

Loerch, Starlene M., John L. Harris, Tracy Klotz, and Brook L. Fluker. Arkansas State University, Department of Biological Sciences.

Restoration And Revitalization The Arkansas State University Museum Of Zoology Ichthyology Collection

The Arkansas State University Museum of Zoology (ASUMZ) Ichthyology Collection represents a significant resource for the ichthyological community, particularly in the southeastern United States. Presently, the collection contains approximately 13,000 specimen lots (approx. 178,000 individual specimens) collected between 1960-2007. Although a large proportion of specimens were collected between 1970-1980 in Arkansas and Missouri, the collection includes specimen lots from 23 of the contiguous United States. In recent times, a substantial proportion of specimen lots have experienced desiccation as a result of unsuitable storage and containers. Additionally, collection data are not currently available digitally for query and public access. Over the past two years, substantial strides have been made to recover specimen lots and associated data. To date, 2,039 of the specimen lots have been transferred to new jars and 330 lots have been selected for rehydration procedures. Digitization of collection data is underway, with the goal of having complete collection data and georeferenced locality information in a single Specify database. The overall goal is to restore this hidden gem into a resource that will support research and education on local and regional scales, while also being readily accessible to the public and scientific community.

McCall[1], Brittany, Erin Bloom[1], Rebecca Blanton Johansen[1], and John Johansen[1,2]. [1]Austin Peay State University, Center of Excellence for Field Biology and Department of Biology [2]Tennessee Technological University, Department of Environmental Sciences.

Seeking Taxonomic Resolution: Is *Orconectes Cf. barrenensis* From The Red River (Cumberland River) Of Tennessee A Distinct Species Of Crayfish?

Surveys of the Red River (Cumberland River) in TN identified populations of a crayfish, referred to as *Orconectes cf. barrenensis*, due to its morphological similarity to *O. barrenensis* and *O. mirus*. However, the latter species do not occur in the Cumberland River system. *Orconectes barrenensis* is endemic to the Green River (Ohio River) in TN and KY, and *O. mirus* occurs in Tennessee River tributaries of TN and AL. Recent phylogenetic analysis of these taxa using molecular markers confirmed *O. cf. barrenensis* was a divergent lineage closely related to *O. mirus* and *O. barrenensis*, but relationships among these taxa were unresolved. The objective of this study was to further evaluate the taxonomic status of *O. cf. barrenensis* using morphological characters. Standard measurements used to diagnose crayfish species were measured for form I males, form II males, and female specimens representing all known localities of *O. cf. barrenensis* and a subset of *O. barrenensis* and *O. mirus* localities. Principle components analysis of standardized measurements showed that form I males of *O. cf. barrenensis* had a wider areola, shorter carapace, rostrum, and mesial projection, and a longer abdomen than *O. barrenensis* and *O. mirus*; and had a shoulder on the cephalic margin of the pleopod that was absent in *O. barrenensis*. Form II males of *O. cf. barrenensis* differed from *O. mirus* in several characters, but were not distinguishable from *O. barrenensis*. Variation in females was broadly overlapping among all taxa. Results demonstrate that the genetically divergent *O. cf. barrenensis* (Red River) is also distinguisha-

ble from its close relatives by a combination of morphological characters. However, elevating *O. cf. barrenensis* to species would render both *O. barrenensis* and *O. mirus* paraphyletic under the current gene-based hypothesis of relationships. Further study is needed for systematic resolution.

McCombs, Erin. American Rivers.

Dam Removal: A Guide To Effective Restoration And Prioritization

Dam removal is gaining momentum as a restoration tool to increase aquatic connectivity, public safety, and recreational opportunities. Over 80,000 dams exist on our streams nationwide. While some of these dams are still providing energy through hydropower and protecting communities as flood control, the vast majority of these structures are no longer serving their intended purpose like powering saw mills, grist mills, or textile mills. With limited resources and thousands of small and medium sized dams to prioritize for removal, information to guide the process is of principal importance. This presentation will attempt to guide resource managers to the best practices for prioritizing and removing dams and offer case studies from completed projects in North Carolina as well as elsewhere in the Southeast. General steps for a dam removal will be covered including initial reconnaissance, site visits, planning meetings, fundraising, design and engineering, community outreach, permitting, project implementation, and monitoring. An overview of a GIS based barrier removal prioritization decision making tool for North Carolina will be presented and made available to interested parties.

Meador, Jason. The Land Trust for the Little Tennessee.

Using A Non-Governmental Organization As A Catalyst For Stream Habitat Enhancement On Private Lands

Good relationships are necessary when seeking permission to access private lands, even more when proposing to work on such lands. However, local non-profits can serve as liaisons between landowners and agency or university personnel. Through a 25 year fish-monitoring program, the Land Trust for the Little Tennessee (LTLT) has developed amicable relationships with streamside property owners. Through one of these relationships, a multi-phase, multi-agency project was completed. Beginning with an initial objective to identify and remove a barrier to fish passage, we were able to progress to stabilizing 300 linear feet of streambank and installing structures to enhance fish habitat. Mutual benefits abound due to the level of trust the landowner has with a person from a local organization. Likewise, the local organization can identify the best match of program funds, based on the given conditions of the property.

Moyer, Gregory R. United States Fish and Wildlife Service, Conservation Genetics Laboratory,

Planning A Reintroduction With Emphasis On Genetic Considerations

The southern United States is estimated to have the largest number of threatened species on the continent and projected extinction rates per decade in North American fresh waters are far higher than in the terrestrial environment, approaching the rate of extinction in tropical forests. In response to aquatic habitat degradation from a variety of human activities, habitat rehabilitation has become commonplace; in concert, so too are attempts to return species to parts of their historical ranges where they were once extirpated. Reintroductions can be an effective conservation tool; however, risks associated with reintroduction efforts are capable of affecting the focal species, their communities, and ecosystem functions and can impact people and their livelihoods. In this presentation I will use examples from numerous rare fish reintroductions to advocate the need for formal reintroduction planning and discuss genetic considerations for the reintroduction of threatened and endangered organisms. Particular emphasis will be placed on the use genetic tools to assess and prioritize conservation units, estimate genetic diversity, minimize genetic risks associated with hatchery propagation, and monitor the genetic diversity of the reintroduced population.

Near, Thomas J.. Department of Ecology & Evolutionary Biology and Peabody Museum of Natural History, Yale University.

Genetic And Morphological Diversity In The Imperiled Striated Darter *Etheostoma striatulum*

The Striated darter, *Etheostoma striatulum*, is a species of barcheek darter (*Oopareia*) endemic to the mid-to-upper portion of the Duck River system. The distribution of this species within this restricted geographic region has been in decline since the early 1990s. The farthest downstream population of *E. striatulum* in the Duck River system was discovered in the Big Bigby Creek system in the mid 1980s, which is geographically disjunct from the more upstream populations of the species. This study aims to document genetic and morphological diversity among populations of *E. striatulum* to determine if the geographically disjunct populations are independent evolutionary lineages. Specimens were sampled from most historical localities and DNA sequences were obtained from the mitochondrial gene cytochrome *b*. A gene tree inferred from the

mtDNA sequences resolves two well-supported clades that correspond to the two sets of geographically disjunct populations of *E. striatulum*, namely the Big Bigby Creek system and all other upstream sampling localities. Haplotype diversity is higher in the upstream Duck River clade, but specific haplotypes are shared among sampling locations. Variation in meristic morphological traits scored from more than 100 specimens reveals divergence between the Big Bigby Creek population and the upstream Duck River populations. This microendemic diversification within the geographically restricted Duck River system is observed in other lineages of barcheek darters and has important implications for the conservation and management of this imperiled species.

Near[1], Thomas J., Ethan France [2], and Richard C. Harrington [3]. [1]Department of Ecology & Evolutionary Biology, Peabody Museum of Natural History, Yale University, [2] Stiles College, Yale University, [3] Department of Earth Sciences, University of Oxford, UK.

Taxonomic Status Of The Snubnose Darters *Etheostoma simoterum* And *E. tennesseense*

A taxonomic revision of *Etheostoma simoterum* published in 2007 resulted in the recognition of six species, with two species distributed in the Tennessee River system. A newly defined *Etheostoma simoterum* (Cope) was restricted to populations in the Holston River above the confluence of the North and South Forks and a newly described species, *E. tennesseense* Powers & Mayden, distributed in the Tennessee River system from Hardin Creek to the Clinch River, including the Holston River below the Forks. A subsequent study utilizing molecular species delimitation analyses did not support the recognition of *E. tennesseense*, as specimens from the Holston River below the Forks were resolved as more closely related to specimens of *E. simoterum* then either was to specimens of *E. tennesseense* sampled from other populations in the Tennessee River. In addition, there was a noted similarity in male nuptial coloration patterns in specimens of sampled above and below the Forks of the Holston River, indicating that male coloration patterns are not diagnostic for the more restricted and new definition of *Etheostoma simoterum*. In this study we examine the systematics of *Etheostoma simoterum* using meristic traits sampled from more than 900 specimens, including the *Etheostoma simoterum* syntype series. Our analyses show a pattern of clinal variation in the Tennessee system. Comparisons of populations above and below the Forks of the Holston show no differences in meristic traits, but populations sampled from the Watauga River system exhibit lower scale counts than any other population of *Etheostoma simoterum*. Examination of the syntype series indicates they are more similar to what was described as *E. tennesseense* than to the newly defined *Etheostoma simoterum*. The conclusions of our study, now based on both morphological and molecular species delimitation strategies, include treating *E. tennesseense* as a synonym of *Etheostoma simoterum*.

Pandolfi, Gary, Jason Selong, M. Worth Pugh, Thomas Franklin, Daniel Mason and Michael M. Gangloff. Appalachian State University, Department of Biology. Boone, NC.

Influence Of Land Use And Stream Physicochemical Habitat On New River Fish Communities

The New River Drainage in northwestern North Carolina has undergone substantial changes in landuse during the last 100 years. Historical land clearing led to a loss of primary forest cover in the early 20th century and subsequent conversion to agricultural land. More recently, ex-urban development has transformed formerly agricultural and forested lands into residential communities. These changes may have important implications for the New Drainage's endemic fishes. The upper New River Drainage supports populations of ~40 fish taxa including nine taxa of conservation concern, four drainage endemics Kanawha minnow (*Phenacobius teretulus*), New River shiner (*Notropis scabriceps*), Kanawha darter (*Etheostoma kanawhae*) and Appalachia darter (*Percina gymnocephala*), and multiple introduced species including Rainbow trout (*Onchorynchus mykiss*), Red lip shiner (*Notropis chiliticus*), Saffron shiner (*Notropis ribicrocerus*) and Brown tout (*Salmo trutta*) with others pending phylogenetic analysis. Between May and October 2014 we sampled 40 sites across the drainage to examine how landuse changes influence 1) the distribution of endemic and introduced fishes and 2) how in-stream habitat parameters affect fish community structure. Preliminary data suggest that endemic and sensitive fishes are largely restricted to forested mainstem reaches of the South Fork New River and the lower reaches of larger tributaries. However we also detected 28 taxa including 3 drainage endemics in the South Fork New River adjacent to the Greenway trail network in downtown Boone, NC suggesting that even localized patches of forested land may benefit native fishes. Introduced fishes were most abundant in headwaters (stocked and naturalized trout) and lower-elevation tributaries in Ashe County. On-going analyses will model temporal and spatial changes in site occupancy by endemic and putatively introduced fishes across the New River Drainage and identify linkages between landuse, habitat and fish community changes.

Peoples, Brandon K., Emmanuel A. Frimpong. Virginia Polytechnic Institute and State University, Department of Fish and Wildlife Conservation.

Nest Association Drives Cyprinid Community Structure: Preliminary Evidence For The Stress-Gradient Hypothesis In Vertebrate Communities

Little is known about how positive biotic interactions structure vertebrate communities. Nest association, a communal spawning activity among fishes, is a reproductive facilitation in which associates spawn in nests constructed by hosts. Interaction networks in stream fish communities driven by this interaction can be complicated by spawning mode plasticity; nest associative behavior is nearly obligate for some associates, but facultative for others. Nest web models can aid in understanding interaction topologies in nesting-structured communities, but have thus far only been applied to birds. We used structural equation modeling (SEM), implemented through an information-theoretic framework, to identify the most plausible nest web topology in among cyprinids in the New River Basin of the central Appalachians. We then sought to identify the contexts in which nest association would be an important driver of community structure, using the stress-gradient hypothesis (SGH, most frequently used by plant ecologists) to generate predictions. The SGH predicts that the importance of facilitation should increase with physical stress. We defined physical stress as the combination of stream size and anthropogenic disturbance, and interaction importance as (1) the per-nest reproductive success of species that rely strongly on hosts for reproduction, and (2) the domination of community structure by these species and their hosts, quantified as an eigenvector from principal coordinates analysis (PCoA). SEM model evidence supported a parsimonious nest web in which strong associates rely on a single host (*Nocomis*), and members of other reproductive groups do not frequently engage in nest association. Similarly, PCoA results suggested a gradient of community structure dominated by *Nocomis* and associates, to communities dominated by other reproductive groups. Both metrics of facilitation importance responded positively to physical stress. This study suggests that vertebrate communities can be driven by positive interactions, and that the SGH can generate useful predictions about their composition.

Pfleger[1], Mariah O., Carol E. Johnston[2], Steven J. Rider[3], Alexis M. Janosik[1]. [1]University of West Florida, Department of Biology, [2] Auburn University, Department of Fisheries, [3]Alabama Division of Wildlife and Freshwater Fisheries.

Traditional Sampling Detection vs. Environmental DNA Detection

Detection of aquatic species is imperfect, especially if the species is rare and exhibits spatial and temporal variability. Many fish species require a number of sampling trips before detection is positive. And yet, information on species persistence is critical for effective conservation efforts. If a species is not detected with traditional sampling, questions remain: Was it present but not collected? Was the timing of sampling incorrect for detection? Forensic genetic techniques, such as environmental DNA (eDNA), have been developed and successfully used to validate the presence of exotic aquatic species in new areas. We compare traditional sampling techniques with eDNA techniques in *Etheostoma boschungi* and *Acipenser oxyrinchus desotoi*. Species detection through the use of eDNA proves significantly more effective than traditional sampling.

Powell [1], Jeffrey R., Patrick E. O'Neil [2], and Paul D. Johnson [3]. [1]U.S. Fish and Wildlife Service, Daphne, Alabama, [2] Geological Survey of Alabama, Tuscaloosa, Alabama; [3] Alabama Department of Conservation and Natural Resources – Alabama Aquatic Biodiversity Center, Marion, Alabama.

Restoring Habitats And Recovering Species One Shu At A Time

Alabama's rivers are recognized for their freshwater biodiversity with more than 310 native fishes, 180 mussels, 160 snails, and 85 crayfishes, many of which are critically imperiled. In an effort to conserve this unique fauna, preserve watershed health and integrity, improve water quality, and most importantly, build trust among the citizens of Alabama; the Alabama Rivers and Streams Network has identified 51 high priority watersheds known as Strategic Habitat Units (SHU). SHUs focus conservation activities on Alabama's more than 225 listed and imperiled fishes, mussels, snails, and crayfishes. SHUs are primarily based on the number and presence of federally listed and state priority species, but they also take into consideration the number and magnitude of threats, defined critical habitat(s), and key habitat components required for species survival. Goals of the SHU process are habitat restoration and species recovery. SHU habitat recovery efforts are implemented by working with landowners, agencies, NGOs, and industry to restore habitats and enhance opportunities for aquatic species conservation through collaborative watershed/habitat assessments, restoration of stream habitats, propagation and culture of imperiled species, and reintroductions of rare species into areas of their former range.

Rash[1], Jacob, Barbara Lubinski [2] Tim King[2]. [1] North Carolina Wildlife Resources Commission [2] USGS-Leetown Science Center.

Comparison Of Historic And Contemporary Molecular Methods To Assess North Carolina's Brook Trout

The North Carolina Wildlife Resources Commission (NCWRC) has been involved in a long-term effort to identify and genetically type wild Book Trout populations within the state. To date, over 600 wild Brook trout populations have been identified and of these, 480 have been genotyped at the creatine kinase locus. Results from allozyme testing indicate that 38.3% of the populations are southern origin, 9.6% are northern origin and 52.1% are of mixed genetic origin. Although these historic data have contributed to the NCWRC's understanding of the state's Brook trout populations, knowledge gaps concerning genetic relationships of the species within North Carolina persist. To address this research need an extensive survey of genetic diversity and variation at 13 microsatellite loci is being conducted. To date, this research has been able to provide significant insight into demographic history of and the evolutionary relatedness among previously uncharacterized Brook trout populations. Utilization of microsatellite loci and pooling both phylogeographic and hatchery collections as a baseline for assignment scores provided us with a sound methodology to examine hatchery influence and heritage within collections. However, initial comparisons between allozyme and microsatellite assignments show inconsistent agreement. Thus far, tissue samples from 57 collections have been compared via the two techniques and 42.1% (N = 24) of collections received different assignments than those provided by original allozyme analyses. This differentiation is important to managers as they reflect on historic data and its implications to past, present, and future conservation efforts.

Ray, Jeffery M., Joseph W. Schafer, Amanda L. Oliger. University of North Alabama, Department of Biology.

Expansion Pattern Of *Notropis texanus* (Weed Shiner) In The Tennessee River Drainage

Weed shiner *(Notropis texanus)* is native to many river systems of central North America, but is considered an introduced species in the Tennessee River drainage. Since completion of the Tennessee-Tombigbee waterway, *N. texanus* has been documented from the Tennessee River and its tributaries both upstream and downstream of the Tenn-Tom. Over 100 collections of *N. texanus* from 1990–2014 were compiled from various sources and mapped chronologically. Additional targeted sampling used a component of the Geological Survey of Alabama's 30+2 method to document the presence and relative abundance of *N. texanus* in the fish community, with efforts focused on upstream-most collection locales, particularly in Cypress Creek, Lauderdale County, AL, where *N. texanus* was first found in 2009. Historical and recent sampling revealed a progressive colonization of upstream tributaries in the Pickwick Reservoir reach of the Tennessee River and a variable, but sometimes rapid increase in relative abundance in collections. Future sampling will document additional range expansion into tributaries above Wilson Dam and potential changes in fish community composition.

Roberts, James H. Georgia Southern University, Department of Biology.

A New Framework To Evaluate And Avert Risks To Fragmented Populations Of Stream Fish

Many populations of stream fish persist in remnant patches that are isolated by anthropogenic barriers. Risk-averse management of such populations could involve either of two contrasting strategies: (1) restoration of connectivity, which averts risks associated with small population size, or (2) maintenance of isolation, which averts risks associated with the mixing of divergent gene pools. The optimal strategy depends on the relative magnitudes of these "small-population" (SP) versus "outbreeding-depression" (OD) risks, which depend on the demographic and genetic characteristics of populations and evolutionary relationships between populations. We developed a framework to facilitate comparison of SP and OD risks based on published risk criteria and commonly available data. To illustrate how the framework could guide conservation choices, we applied it to seven isolated populations of Roanoke logperch (*Percina rex*), an endangered stream fish. Both risk types varied considerably among populations, suggesting that a uniform management strategy would be ineffective. Only one population exhibited low risk for both types, whereas four exhibited high SP (but not OD) risk and two exhibited moderate OD (but not SP) risk. Based on this analysis, four *P. rex* populations could benefit from restored connectivity, whereas two should remain isolated. Our approach could be used to develop transparent, science-based management strategies for *P. rex*, as well as other rare or imperiled taxa.

Rottmann, Erica N. and Kyle R. Piller. Southeastern Louisiana University.

Revealing What Lies Beneath: Utilizing Environmental DNA (eDNA) To Detect Rare Fishes In Louisiana

The relatively new environmental DNA (eDNA) technique has proven to be a valuable monitoring tool for the detection of invasive and imperiled aquatic organisms, but it has yet to be comprehensively utilized in the southern United States where the usefulness of this approach may be impacted by more rapid DNA degradation due to higher water temperatures and other chemical and physical characteristics of southern waters. Southeastern Louisiana has a large number of imperiled aquatic species that are in need of study from a conservation perspective. A cost-effective, non-invasive monitoring approach is needed to assess the conservation status of many aquatic species in the region. In previous studies, there has yet to be standardi-

zation of the methodology for eDNA sampling. This project had two objectives. First, we conducted laboratory and field experiments on a locally abundant fish, the Blacktail shiner, *Cyprinella venusta*, to test the efficiency of several common extraction and amplification methods in an effort to shed light on the most reliable protocols for eDNA sampling in this region. Second, we used both eDNA and traditional field sampling techniques in a seasonal sampling approach to assess the conservation status of two imperiled taxa in the Lake Pontchartrain Basin, the Gulf logperch, *Percina suttkusi*, and the Flagfin shiner, *Pteronotropis signipinnis*. Both species are known to occur historically in a limited number of localities in the basin making them ideal candidates for field-testing of the eDNA method. Each species was detected at a greater number of sites based on eDNA samples in comparison to traditional sampling techniques, further supporting the usefulness of this technique.

Russ, T.R. and Steve Fraley. North Carolina Wildlife Resources Commission.

Long-Term Spotfin Chub (*Ericmonax monachus*) Monitoring In The Little Tennessee River, North Carolina: Overview And Results For Eight Years

A 10-year effort to assess the Spotfin chub, *Erimonax monachus*, population in the upper Little Tennessee River began in August 2007. The monitoring protocol was designed to meet criteria defined in the species Recovery Plan (USFWS 1983) and is available as a model for population status assessment range-wide. Goals are: 1) assess spatial and temporal distribution and abundance over a 10 year period; 2) provide information to guide management decisions, recovery efforts, and further research; and 3) provide any additional life history and habitat use information as observed. Ten sites were selected within the 23 mile (37 km) occupied reach. Visual surveys (mask and snorkel) along fixed transects and timed, random searches were conducted at each site. In 2007, the lowest population level was observed with 2.7 total chubs (adults and sub-adults combined) per 50m transect (transect) and 5.8 chubs per hour of random search (hour). Since 2007 the population has increased but fluctuated with high levels of sub-adults in 2010 (9.8 per transect and 38.0 per hour). The same cohort translated into the highest adult observations in 2011 (10.0 per transect and 36.2 per hour). In 2012 and 2013, the population trended downward, continuing in 2014, when number of adult observations was the lowest in eight years (1.1 per transect and 2.6 per hour); however, sub-adults were consistent with several years' past observations (2.4 per transect and 8.6 per hour). The 2010 cohort appears to have been very important in maintaining the population for the past four years.

Saco, Heather Allaben, Ginny Adams, Reid Adams. University of Central Arkansas.

Changes In Land Use And Fish Assemblages In Sylamore Creek Over A Thirty-Nine Year Period

Long-term studies evaluating land use and fish community structure are often lacking but necessary to further understanding of anthropogenic influence on local fish assemblages. Land use is known to influence the health of aquatic ecosystems, and alterations may result in negative impacts including increased sedimentation, nutrient enrichment and loss of habitat. Sylamore Creek is a tributary of the White River in Stone County, Arkansas. During June 2014, we sampled fishes at 10 sites within the Sylamore Creek watershed. Sites, dates and sampling methodology were consistent with a previous data set collected during 1975. Fish assemblages will be compared with historical data using non-metric multidimensional scaling. Fish metrics (species richness, percent tolerant, percent intolerant, etc.) will be analyzed in relation to change in land use type. Land use change will be determined using current GIS technology as well as remote sensing for historical data. Results from this comparative study will be a valuable contribution to the long-term evaluation of fish community structure in Sylamore Creek. Further comparative investigations of additional Arkansas upland stream systems will follow.

Saidak[12], Christina, Mark Cantrell[1] Dr. Larry Wilson[2]. US Fish and Wildlife Service[1] The University of Tennessee[2].

Movement Ecology And Dispersal Patterns Of Reintroduced Lake Sturgeon In The Upper Tennessee River System

We investigated dispersal and movement patterns of reintroduced, wild, hatchery-reared Lake Sturgeon in the Upper Tennessee River system. Lake sturgeon were extirpated since the 1960s, but reintroduced as young-of-year fingerlings since 2000. Currently there are limited data on movement or habitat preferences of these maturing, naturalized fish. Movement and dispersal patterns monitored by acoustic telemetry have helped us identify, map and assess seasonal habitats of 42 sub-adult Lake sturgeon at Fort Loudoun, Watts Bar and Chickamauga Reservoirs. We have assessed water quality conditions in areas occupied by Lake sturgeon. We have also identified potential spawning and staging areas by direct observations, reports collected from local fishermen, and the expert opinions of biologists.

Schmidt, Bjorn, Jake Schaefer, and Brian Kreiser . The University of Southern Mississippi, Department of Biological Sciences.

Population Genetic Patterns Of *Semotilus atromaculatus* Across Six Drainages In Mississippi And Arkansas

A comparative study was done to examine overall population structure and within drainage gene flow patterns of Creek chub, *Semotilus atromaculatus*, in four Mississippi drainages (Bayou Pierre, Big Black River, Pascagoula River, and Pearl River) and two Arkansas drainages (Black River and Little Red River). A total of 540 creek chub were sampled by backpack electrofishing in 2011-2012, and fin clips were kept for genetic analysis in a salt or ethanol solution. Ninety fin clips were obtained from each drainage, and within each drainage were 6 sample localities consisting of 15 fish. Eight microsatellite loci were used to genotype each fish. A hierarchical analysis using the program STRUCTURE was performed on the combined dataset, where each identified population was run independently with the program until panmixia was indicated. The program MIGRATE was also used to compare various models of population connectivity and gene flow for the different drainages. These results were compared with variables of intervening habitat to examine the influence of connecting habitat on gene flow. There were differences in allelic richness among the drainages, and the geneflow patterns varied among the different drainages. Characteristics of the intervening habitat were found to have an effect on geneflow patterns in some of the drainages. Future work will include a comparison of these results with other small stream resident fishes (*Fundulus olivaceus*, *Erimyzon oblongus*, *Etheostoma artesiae*, and *E. parvipinne*) in these same drainage systems.

Settle, Shawn Patrick and Rebecca Blanton Johansen. Center of Excellence for Field Biology, Austin Peay State University.

Conservation And Habitat Use Of Coastal Plain Madtoms

Compared to other regions, the Coastal Plain of west Tennessee has been understudied with respect to aquatic fauna. Unfortunately, this area has been heavily impacted by agriculture practices, which have contributed to large-scale changes in flow and habitat complexity of river systems. Benthic fishes, such as madtoms (Ictaluridae: *Noturus*), are particularly sensitive to such disturbances. Several species of madtoms occur in these streams, including *Noturus gladiator*, which is a candidate for federal protection. To assess the status of this species and better understand habitat requirements and potential impacts of anthropogenic activities on this and other madtoms. Historical localities of *N. gladiator* were surveyed and reach-scale and kick-scale habitat measurements were taken. A total of 13 *N. gladiator* were found at only 4 of 15 historical localities sampled. Other more common and abundant species of madtoms collected and examined included *N. hildebrandi, N. phaeus*, and *N. miurus*. For all madtoms, presence was significantly and positively correlated with overall habitat quality scores and with availability of cover in the reach. At the kick-scale, madtom presence was significantly and positively correlated with woody debris, which likely serves as diurnal cover for all madtoms. Other kick-scale features, such as the erosional or depositional condition or position in the stream channel (e.g, lateral, mid-channel), were significantly correlated with species presence, but varied among species. For example, *N. hildebrandi* were typically found in mid-channel riffles, whereas *N. miurus* were found in lateral position, depositional areas. This variation suggests that although madtom species require woody debris cover, cover patches are partitioned among species based on other microhabitat variables. These results support the need for conservation actions that improve or maintain riparian zones and natural flow regimes to enhance overall habitat complexity and ensure Coastal Plain streams continue to support a diverse catfish fauna.

Sheldon[1], Andrew L., Melvin L. Warren,Jr. [2], Wendell R. Haag [2]. [1]University of Montana, [2] USDA Forest Service, Center for Bottomlands Hardwoods Research.

Bundling Fishes: What Can We Learn About Madtoms And Darters?

Woody material is important habitat for small cryptic fishes e.g. madtoms (*Noturus* spp.) and darters (*Percina* spp., *Etheostoma* spp.) in sandy coastal plain streams where other cover is scarce. We constructed standardized woody microhabitats (cane bundles) to investigate habitat use by madtoms and darters and to evaluate a sampling program based on artificial habitat units. We deployed 30 bundles in each of three northern Mississippi streams six times over one year for total n=540 bundles. Four *Noturus* and five darter species were collected. Although only 30-50% of bundles contained madtoms or darters and mean density was <1.0 fish/bundle, repeatable patterns were detected within and among streams. All three streams demonstrated annual cycles of occurrence in bundles including winter-spring maxima of *Percina sciera*. Summer peaks of *Noturus phaeus* occurred in two streams. Seasonal replacements are suggested among four *Noturus spp*. in one stream. Depth and velocity of bundle placement influenced use by *N. hildebrandi* (fast), *N. miurus* (slow) and *N. nocturnus* (intermediate) ($P<0.003$). *Etheostoma artesiae* occupied shallow sites and *E. lynceum* deeper ones ($P<0.007$). We suggest improvements and extensions for users of bundles and other artificial microhabitats and possible application in restoration programs.

Simpson, Raymond and Thomas Near. Yale University, Ecology and Evolutionary Biology.

Southern Sander: Evidence For A Cryptic Species Of Walleye In The Mobile Basin

The Walleye (*Sander vitreus*: Percidae) is an important game fish widely distributed in the eastern United States and Canada. For many years the southern-most population, restricted to the upper Mobile basin of Alabama, Mississippi and Georgia, was recognized as an undescribed lineage. Using three mitochondrial and ten nuclear gene sequences, southern Sander populations were compared to the nominate race from the Great Lakes. Meristic and morphometric data was also gathered for the Mobile lineage and compared to specimens from the type locality of Cayuga Lake, NY and the vicinity. The results indicate two well-supported clades corresponding to the drainage sampled. There seems to be at least one cryptic species lumped within *Sander vitreus*, with the nominate race restricted to the northern part of the range, and a new species endemic to the Mobile drainage. Since the Walleye is widely stocked in North America from the northern population, the effects of hybridization and its impact on conservation of this cryptic species are important points for management of the native species.

Stiles, Warren and Carol Johnston. Auburn University.

Water Availability As A Catalyst For Stream Fish Assemblage Shifts In Alabama

Prolonged decreases in water availability, combined with habitat loss, have the potential to cause fish faunal homogenization in southeastern stream ecosystems. In addition to natural drought, land use changes and human consumption have contributed to an overall decline in stream discharge in our study streams. Our objective is to investigate the role of water availability on fish assemblage persistence in seven study streams in Alabama. The study streams represent various physiographic regions in the state, and have historical data on fish assemblages. We sampled sites on study streams for two years to provide a short-term comparison to validate our methods, and used similarity indices to compare our current collections between years, and to historical data. Water discharge, land use data and persistence of water in channel will be examined as factors contributing to fish assemblage persistence or change. A preliminary analysis indicates that the study stream with a completely forested watershed has retained virtually complete similarity to historical assemblages, while streams with more disturbed watersheds have had significant fish assemblage change.

Thomas1[1], Matthew R., Stephanie L. Brandt[1], Patrick L. Rakes[2], J.R.Shute[2], Crystal L. Ruble[2], Melissa A. Petty[2]. [1]Kentucky Department of Fish and Wildlife Resources, [2]Conservation Fisheries, Inc.

Captive Propagation And Reintroduction Of The Kentucky Arrow Darter, *Etheostoma spilotum*, In The Upper Kentucky River Drainage, Clay County, Kentucky

The Kentucky Arrow darter, *Etheostoma spilotum*, is endemic to headwater streams in the upper Kentucky River drainage of eastern Kentucky. Recent surveys have revealed significant population declines, particularly where coal mining, gas/oil exploration, and land development have intensified in recent decades. Based on these factors, *E. spilotum* has been assigned candidate status for listing under the Endangered Species Act. Conservation Fisheries, Inc. successfully developed captive spawning protocols and has begun producing offspring needed to re-establish extirpated populations within the species' historic range. We selected Long Fork, a 3.6 sq km tributary of Hector Branch (Red Bird River drainage), as a suitable stream for reintroduction because habitat conditions were suitable but it was isolated and did not contain a pre-existing population of *E. spilotum*. Beginning in 2012, captive spawned individuals were marked with visible implant elastomer (VIE) tags and released in Long Fork on an annual basis, followed by monthly surveys to assess survival and movements. Monitoring efforts so far have confirmed the survival of tagged individuals in Long Fork for periods of up to two years. Tagged individuals were detected during every survey event, with an increasing trend in numbers of untagged individuals in 2013 and 2014. Over 50% of fish recaptured were concentrated in the upper extent of the 1.5 km section of stream where they were released and several had moved up to 300 m upstream of the release section; fewer individuals were recaptured below the release section and out into Hector Branch. These results, suggesting dispersal of stocked fish in the stream followed by successful reproduction and recruitment are encouraging; however, other non-game fish restoration attempts have shown it takes several years to document success when stocking relatively limited numbers of individuals, particularly small species that are short-lived and cryptic.

Tracy, Bryn H. North Carolina Division of Water Resources.

Removing A Stream From North Carolina's §303 (D) List – The Richland Creek Fish Re-Introduction Project

The Division of Water Resources (DWR), along with NC Wildlife Resources Commission (NCWRC), University of Tennessee-Knoxville (UT-K), and Haywood Waterways Association, and Evergreen Packaging, are working together on an innovative project designed to remove Richland Creek – a tributary of the Pigeon River near Waynesville, North Carolina – from North Carolina's §303(d) impaired waters list. The project is modeled after the successful bi-state Pigeon River Re-introduction

Project led by UT-K and NCWRC. Richland Creek has had historic and long-term poor water quality, hydrologic modifications, habitat degradation, fish kills, and impaired biological integrity. After a decade of water quality enhancement projects, water quality had improved to a level suitable for the re-introduction of several indigenous fish species to reaches of the creek upstream from Lake Junaluska whose dam has been a barrier to fish re-colonization since 1913. River chub, Warpaint shiner, Saffron shiner, Mottled sculpin, Rock bass, Fantail darter, Tuckasegee darter, and Greenfin darter are collected, transported to upstream reaches and released twice a year for three years, or until the species establish reproducing populations. Since April 2010, more than 22,000 fish representing these eight species, plus Mirror shiner, Telescope shiner, and Tennessee shiner, have been collected from nearby source populations and re-introduced at multiple sites along Richland Creek. Reproducing populations and longitudinal dispersal have now been documented for most of the re-introduced species. Results from DWR's 2012 monitoring resulted in a Good-Fair biological integrity rating for the fish community, an improvement from the Poor and Fair ratings received in 2001 and 2007. With these re-introductions, removal of the stream from the impaired waters list is expected. Long-term success of the project will require continued habitat enhancements, urban stormwater management, and other water quality improvements that will maintain acceptable water quality in Richland Creek.

Walker [1,2], Daniel, Mark Cantrell [2], Steve Alexander [3], Dr. Brian Alford [1]. [1] University of Tennessee, Department of Forestry, Wildlife and Fisheries [2] U.S. Fish and Wildlife Service, Ecological Services, Asheville, NC [3] U.S. Fish and Wildlife Service, Ecological Services, Cookeville, TN.

Substrate Characteristics And Potential Contaminant Exposure Risk Of Lake Sturgeon Habitat In The Upper Tennessee River

One of the goals established by the Southeastern Lake Sturgeon Working Group for restoring the Lake Sturgeon (*Acipenser fulvescens*) to its historic range in the Tennessee River system is to describe the habitat utilization of reintroduced Lake sturgeon at a microhabitat scale and determine the availability and quality of habitat for these fish in the Tennessee River system. During June and July 2014, we located acoustic-tagged Lake sturgeon in Fort Loudoun and Watts Bar reservoirs and collected substrate samples from their estimated locations. We collected sediment associated with locations of 20 subadults that varied in size, age, and gender. We created substrate profiles to describe the microhabitats for each fish location, and compared the profiles between reservoirs and among Lake sturgeon size classes. The habitat utilized by Lake sturgeon was dominated by clay and silt particles (<63 μm diameter; 71% of total dry mass sample). ANCOVA testing did not support significant differences in the habitat among size classes, likely due to the predominance of fine particles in all habitats. Additionally, we collected samples from five locations across an area of known Lake sturgeon use for contaminant testing and tested for heavy metal and trace element content. The most prevalent trace elements detected (>200 mg/kg) were iron, aluminum, calcium, magnesium, manganese, potassium, and total organic carbon. Contaminants potentially harmful to Lake sturgeon (mercury, cadmium, copper, chromium, arsenic, strontium) were also detected. The presence of these heavy metals and trace elements generally correlated with the amount of clay in the substrate sample, suggesting that the majority of summer habitat utilized by Lake sturgeon in the Upper Tennessee River system may increase their risk for exposure and bioaccumulation of harmful contaminants. Future research will further characterize Lake sturgeon habitat and investigate the distribution of harmful contaminants.

Welsh[1], Stuart A., and Joni. L. Aldinger[2]. [1] U.S. Geological Survey, WV Cooperative Fish and WIldlife Research Unit, [2] West Virginia University

Eel Ladders And Dam Passage Of Upstream Migrant American Eels In The Shenandoah River Drainage

Eel ladders have been used successfully to pass American eels upstream at dams, but few monitoring studies have examined long-term datasets of upstream passage counts. We examined a 12-year time series of passage counts (2003–2014) of yellow-phase American eels for an eel ladder at Millville Dam, lower Shenandoah River (Potomac River drainage). Over 22,000 yellow-phase American eels were counted at the ladder during the time series. Passage counts were positively associated with river discharge and negatively associated with lunar illumination. Based on length measurements of 13,780 individuals, the average size of eels using the ladder was 302 mm TL with a range of 183 to 731 mm, although only 45 of 13,780 individuals exceeded 500 mm TL. Age estimates for 233 individuals (214–550 mm TL) ranged from 3 to 11 years. Our data support long-term success of upstream eel passage of an eel ladder on the lower Shenandoah River, and also emphasize the management utility of an eel ladder for monitoring upstream eel migration.

Werneke[1], David C., Eric F. Bauer[1], Jason M. Zink[2], Eve F. Brantley[3], Greg D. Jennings[4], and Brian S. Helms[1]. [1]Auburn University, Department of Biological Sciences [2]Zink Environmental, PLLC [3]Auburn University, Department of Agronomy and Soils [4] Jennings Environmental, Inc.

Preliminary Ecological Endpoint Curves For The Cumberland Plateau Of Alabama

Regional curves relate channel geometry to watershed area and are useful for stream design in restoration efforts. The further development of refined tools integrating realistic ecological endpoints with regional curves can result in improved stream evaluations and designs increasing the effectiveness of restoration projects. Stream regional curves currently do not exist for the Cumberland Plateau region of Alabama. Thus we selected stable reference reaches in 12 relatively undisturbed watersheds in the Sipsey Fork of the Black Warrior River drainage in the Cumberland Plateau of AL to 1) develop regional curves and 2) determine ecological endpoints by quantifying instream and floodplain biotic conditions. Watersheds of selected streams are predominantly forested and range in size from 0.2 – 30 km with channel widths from 0.5 – 15 m. Power function relationships describing channel dimensions as a function of watershed drainage area will be presented. Fish and crayfish assemblage structure show predictable taxonomic and functional relationships with drainage area across the sites and thus can be used as an indicator of ideal biotic condition associated with a given stream size. Thus these ecological endpoint curves can be used in conjunction with regional curves to determine need, set objectives, and evaluate ecological success of stream restoration efforts.

Weyand[1,2], Courtney, Zachary Holtel[2], Eva Grebe1[2], Sarah Lundin-Schiller[2] and Rebecca Blanton Johansen[1,2]. [1]Center of Excellence for Field Biology, Austin Peay State University, Clarksville, TN 37040. [2]Department of Biology, Austin Peay State University, Clarksville, TN 37040.

Quantitative Microscopic Analysis Of Darter (Percidae: Etheostomatinae) Scale Morphology

Agassiz classified fishes into four groups based on scale morphology. Since then, variation in scale number and arrangement has been routinely used in systematic studies of fishes. Through use of improved microscopy technology, recent studies have shown significant variation in the microstructure of fish scales, revealing characters that helped refine species diversity estimates. The species-rich darter clade (Percidae: Etheostomatinae) has a vast research history, although studies of variation in scale microstructure have been few and limited to a small number of species. The systematic implications of these previous studies were based on hypotheses of diversity and phylogeny that have since been refined. Using confocal microscopy and associated software, the goals of this study were to describe variation in the microstructure of darter scales and evaluate variation in the context of modern estimates of diversity and phylogeny. Scale shape and meristic data were taken from 236 individuals, representing 80 species, all genera, 26 subgenera, and 29 clades of darters. Variation in the number of ctenii and radii was observed among genera (e.g., *Percina* ctenii, radii: x =19.9, 9.3; *Nothonotus:* x =25.3, 13.4; *Etheostoma:* x =24.9, 13.4; *Crystallaria:* x =11.0, 6.3; *Ammocrypta:* x =8.1, 6.9), subgenera, and clades. Multivariate principal components analysis revealed variation in scale shape among subgenera and clades of *Percina* and species of *Ammocrypta* and *Nothonotus.* Clades and subgenera of *Etheostoma* showed considerable overlap in scale shape due to high levels of variation within each group, suggesting that for this genus, scale shape may be best explained at finer taxonomic levels (e.g., among species). Overall, scale microstructure characters can be used to inform taxonomic studies of darters, and largely provide support for existing higher-level classifications. Additional investigation is ongoing to determine whether identified characters can refine our understanding of the evolutionary history of this speciose group of fishes.

Williams, Ashantyé S. and Gregory R. Moyer. US Fish and Wildlife Service, Conservation Genetics Laboratory.

Genetic Assessment Of The Lake Sturgeon Reintroduction Program In The Tennessee River

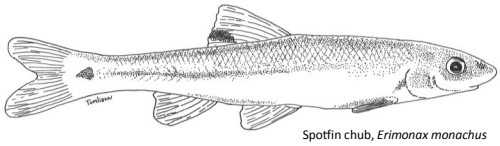
Lake sturgeon is considered an endangered species in Tennessee suffering from overfishing, construction of dams, and destruction of habitat. In 2007 a reintroduction plan was developed for Lake sturgeon in the Upper Tennessee River. Reintroduction programs have become an important conservation tool with the estimation and monitoring of genetic parameters playing a critical role in the success of a reintroduction program. Herein, we used nine microsatellite markers to determine if the genetic diversity of Lake sturgeon from the Wolf River source populations used as broodstock was similar among broodyears and between broodstock and wild-caught progeny from the Tennessee River. The genetic diversity available in the Wolf River Lake sturgeon source population appeared to have been successfully captured by lake sturgeon in the Upper Tennessee River. Estimates of genetic diversity were similar among broodstock years and between a comparison of broodstock and wild-caught progeny. Specifically, average allelic richness was 3.130 and 3.120 for the broodstock (combined broodstock estimate) and wild-caught progeny, respectively. The average expected heterozygosity for the broodstock was 0.458 and similar to that of the wild-caught progeny. These results demonstrate the importance of stocking over several years to achieve desired levels of genetic diversity outlined in reintroduction plan. Additionally, we are using the microsatellite data to evaluate the utility of molecular tags for marking juvenile Lake sturgeon in the Tennessee River and provide assessments and recommendations to the reintroduction program. Our study provides an initial evaluation of the genetic success of the

reintroduction program and while genetic diversity is being maintained, further monitoring will be necessary to determine if indeed the genetic goals of the program have been achieved.

Wolf, Zachary and Rebecca Blanton Johansen. Austin Peay State University, Center of Excellence for Field Biology.

Conservation Status Of The Egg-Mimic Darter (*Etheostoma pseudovulatum*)

Restricted to two counties within the Duck River watershed of Tennessee, *Etheostoma pseudovulatum* is recognized as a state endangered species and has been petitioned for federal listing. Despite this, little is known about the species, including its current abundance and distribution. The most recent status survey (1995) found *E. pseudovulatum* in five tributaries to the Duck River and deemed the overall population stable but threatened by growing disturbances in its range, with the risk of extirpation highest in the three smallest tributaries. The goals of this study were to evaluate the current status of the species, reassess potential or ongoing threats to its persistence, and describe its general habitat requirements. At all historical localities, a closed 75-meter reach was sampled using standard seining techniques. Abundance estimates were calculated using the Petersen Method for a subset of localities. Reach-scale and kick-scale habitat variables were measured and analyzed for correlation with *E. pseudovulatum* presence. *Etheostoma pseudovulatum* was present at all 24 historical localities, including Little Piney Creek, from which it was not observed in the 1995 survey. The species was most often caught in pools with organic debris and at undercut banks with exposed roots. Analysis of habitat variables, size class, and sex ratio data is ongoing. Abundance and population size estimates varied among systems and agreed with the previous survey in that the largest tributary, Piney River, had the largest average abundance (x=101) per site (n=6) and population size (44-234) estimates, while the smallest tributaries (e.g., Only, Happy Hollow, and Little Piney creeks) had the lowest abundances and population sizes (n=4, average: x=29.5, 7-43). Results imply the species remains stable overall, but the risk of extirpation from smaller tributaries remains high due to small population size. Future management efforts should target these potentially isolated, small populations.



Spotfin chub, *Erimonax monachus*