

**Southeastern Fishes Council
Annual Meeting Abstracts
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Abstracts are listed alphabetically by presenter in two different sections: Contributed Oral Presentations and Posters.

RECOVERY OF A LOWLAND FISH ASSEMBLAGE FOLLOWING LARGE-SCALE ROTENONE
APPLICATION IN EASTERN ARKANSAS

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In Spring 2009, Arkansas Game and Fish Commission and U.S. Fish and Wildlife Service attempted to eradicate northern snakehead, *Channa argus*, from the Big Piney watershed in eastern Arkansas by applying rotenone to approximately 640 km of streams. To examine long-term fish community recovery, we sampled at 17 sites in Spring 2009, Summer 2009, Spring 2010, and Summer 2010. Although species richness was unchanged (1-way ANOVA, $F_{3,64}=2.61$, $P=0.059$) over time, many other community characteristics varied. Fish densities increased significantly after the eradication (1-way ANOVA, $F_{3,64}=16$, $P<0.0001$) due to high abundances of YOY. Life history guild was found to significantly affect density (periodic species 1-way ANOVA, $F_{3,64}=7.20$, $P=0.0003$; opportunistic 1-way ANOVA, $F_{3,64}=9.69$, $P<0.0001$; Tukey HSD) with early recolonizing species possessing traits including mobile adults, high fecundity, and/or early reproduction. Trophic structure also changed significantly over time ($\chi^2_{0.05, 4}= 26032.76$, $P<<0.0001$) with variability in proportions of omnivores and invertivores, though piscivores showed relatively little change. Piscivore composition, however, did vary significantly by sample ($\chi^2_{0.05, 4}= 1621.47$, $P<<0.0001$) with an increase in small piscivores and a decrease in large-bodied piscivores. These sustained changes in density by reproductive guild and trophic structure as observed in Summer 2010 indicate this community has not yet recovered, though multivariate analysis indicates a recovering trajectory of all sites.

Keywords: invasive species, eradication, recovery
Drainage: White River
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Contributed Oral

VARIABLE REPRODUCTIVE SUCCESS OF ALLIGATOR GAR, *TRACTOSTEUS SPATULA*,
IN A RIVER-FLOODPLAIN ECOSYSTEM OF ARKANSAS

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We studied spatial and temporal aspects of alligator gar (*Atractosteus spatula*) reproduction in the Fourche LaFave River system to provide data pertinent to the conservation of this declining species. Spawning occurred in floodplain tributaries and generally corresponded with an increase in river stage during late spring/early summer due to flooding from the Arkansas River when water temperatures ranged from 22 C to 27 C. Relative to 2008, 2009, 2010, and 2011, reproductive success in 2007 was high based on number of estimated spawn events (5), number of larvae/early juveniles observed (> 1,000), and abundance of older juveniles the subsequent fall. In 2007, river levels were below flood stage preceding the spawning season and then increased to a high magnitude, long duration flood event during and following reproduction. Reproductive success was absent or low during years when flooding did not correspond with warm temperatures or was of short duration. Low-order, floodplain tributaries are generally undervalued elements of river networks, but they appear to be critical to the reproductive success of alligator gar. As predicted by the flood-pulse concept, reproductive success was highest when long-duration flooding was coupled with warm water temperatures during late spring and early summer.

Keywords: alligator gar; reproductive success; floodplain; Fourche LaFave River

Drainage: Arkansas River

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Contributed Oral

MONITORING RARE FISHES IN NORTH GEORGIA: WHAT ARE WE GAINING FROM SHOCKING, SNORKELING AND SEINING ?

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There is an ongoing need to monitor the status of rare fishes in southeastern rivers using effective methods that account for incomplete species detection. Population data is also needed to evaluate the effectiveness of management actions. We utilized snorkeling and backpack electrofishing to assess the status of imperiled fishes in the Toccoa and Coosawattee River systems. We utilized seining to assess the effectiveness of the Colvard Spring restoration project in the Conasauga River system and a stream restoration project in Raccoon Creek (Etowah River system). The probability of detecting tangerine and wounded darters during snorkel surveys in the Toccoa River was relatively high, suggesting that failure to detect these species did not bias our estimate of their overall status. However, the probability of detecting blotched chubs was relatively low and our raw survey data may have significantly underestimated the number of sites occupied by this species. Compared to snorkeling, the probability of detecting a species while backpack electrofishing was higher for wounded darter, comparable for blotched chub, and much lower for Tangerine darters. Backpack electrofishing can also be used to sample goldline darters with a high probability of detection, but does increase the risk of mortality. Our preliminary analysis of seining data from Colvard Spring and Raccoon Creek indicates that high annual variability may impede our ability to assess the effectiveness of management actions. Our results suggest important considerations for designing future monitoring programs for rare southeastern fishes.

Keywords: detection probability; occupancy; restoration; status assessment

Drainage: Coosawattee; Toccoa; Conasauga; Etowah

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Contributed Oral

POPULATION STATUS AND CONSERVATION GENETICS OF THE FLAME CHUB,
HEMITREMIA FLAMMEA

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The Flame Chub, *Hemitremia flammea*, is an imperiled cyprinid native to spring runs of the Coosa, Cumberland and Tennessee rivers. Due to habitat fragmentation and destruction, this monotypic spring endemic is becoming increasingly rare and in need of a conservation strategy. Currently the species is listed as threatened in Georgia but is of special concern in Tennessee and Alabama, providing little to no protection. In Middle Tennessee, *H. flammea* often co-inhabits springs with Barrens Topminnow (*Fundulus julisia*), and likely has benefited from habitat restoration projects for *F. julisia*. However, there are no conservation projects currently underway for *Hemitremia* specifically. The purpose of this study is to examine the genetic diversity and spatial distribution of genetic variation in *H. flammea* in order to evaluate its current conservation status and provide recommendations on delineation of management units. For this study, individuals from more than twenty populations have been sampled and analyzed using the cytochrome *b* mitochondrial gene. Preliminary analysis recovered three unconnected haplotype networks: 1) individuals from the middle Caney Fork; 2) individuals from the Caney Fork, Barren Fork and Elk rivers; and 3) individuals from the Sequatchie River, South Chickamauga Creek and Upper Tennessee River. All but two pairs of populations analyzed are significantly different, indicating isolation across its range. Results from this study will give insight into genetic diversity both within and among populations, additional data on presence and absence of the species at various localities across its range, and suggested management actions for the Flame Chub.

Keywords: Flame Chub, *Hemitremia*, Cytochrome *b*, Cyprinidae, genetic diversity

Drainage: Tennessee, Coosa, Cumberland

Student Award: Yes

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Contributed Oral

THE SHAPES OF *LYTHRURUS* AND WHAT THEY MEAN FOR SYSTEMATICS AND ECOLOGY

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The species of *Lythrurus* (Cypriniformes: Cyprinidae) were examined with geometric morphometrics in order to determine (1) if shape can delimit species, (2) if shape has phylogenetic signal, and (3) if sympatric species overlap in shape space. In a recent mitochondrial phylogenetic analysis, two clades of *Lythrurus* were proposed – a Northern Clade and a Southern Clade. Using these two clades as a framework, we investigated species-specific shape space patterns. One species, *L. alegnotus*, has been variably considered its own species or a subspecies of *L. bellus*. We found that some populations of *L. alegnotus* were morphologically diagnosable from *L. bellus*; however, the range of *L. alegnotus* differs from published accounts. With respect to the Northern and Southern Clades, we found shape to show no phylogenetic signal as examined by a permutation test. This is likely due to the two clades broadly overlapping in shape space. Despite this overlap, potentially sympatric species generally occupy unshared shape space except for *L. fumeus* and *L. umbratilis*. *Lythrurus fumeus* and *L. umbratilis* are the two species most likely to be encountered together, and they overlap almost completely in shape space. Members of the northern clade show some species-level structure to their distributions while members of the southern clade are broken into two groups of broadly overlapping species: *L. alegnotus* + *L. snelsoni* and *L. atrapiculus* + *L. bellus* + *L. fumeus* + *L. roseipinnis*. These groupings are not monophyletic, suggesting that the species have converged on similar shapes.

Keywords: geometric morphometrics, finescale shiners, ecology
Drainage: Mississippi, Mobile, York, Roanoke, James, New
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Contributed Oral

USE OF AMPLIFIED FRAGMENT LENGTH POLYMORPHISMS (AFLPS) TO RESOLVE
DISCORDANT ESTIMATES OF SPECIES DIVERSITY IN THE FANTAIL DARTER SPECIES
COMPLEX

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Discordance among datasets in estimations of phylogeny is common and can provide insights into the processes that have shaped the evolutionary history of a group. However, disagreement among data types in studies that focus on delimiting species boundaries can lead to challenges recognizing or to erroneous estimates of the true biodiversity of a region. The Fantail Darter, *Etheostoma flabellare*, has been considered a species complex and has been dubbed the largest remaining taxonomic problem in North American freshwater fishes, largely due to complex patterns of morphological variation observed across its range. The species also is highly variable genetically across large and small spatial scales, but species boundaries inferred from genetic data typically are not consistent with those inferred from morphology. To further assess the monophyly of several morphologically distinct forms of the Fantail Darter, an amplified fragment length polymorphism (AFLPs) dataset was generated and used to construct phylogenetic trees using Parsimony and Nei & Li distances. Patterns of genetic structure in the AFLP data set also were compared to those observed in mitochondrial and nuclear intron datasets for the same morphotypes. Preliminary results of these comparisons indicate that AFLPs resolve distinct morphotypes as clades, a pattern that was not observed with the mitochondrial and nuclear loci examined. These results indicate that AFLPs provide sufficient resolution to test hypotheses of species boundaries and offer an alternative to the use of mitochondrial DNA in studies of closely related species.

Keywords: Fantail Darter; AFLPs

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Contributed Oral

PARTICIPATION OF A MINORITY INSTITUTION IN WATERSHED MANAGEMENT

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In 2009, Alabama Agricultural and Mechanical University (AAMU) entered into a Memorandum of Understanding with the Environmental Protection Agency to designate a Center of Excellence for Watershed Management. This Center is one of only five in the southeast and is the only such center at a Historically Black College or University. Our primary focus is the training of minorities and women in natural resource fields using experiential learning techniques. We have developed several classes in forestry, ecology, wildlife, and fisheries that emphasize hands-on learning of current techniques. We also carry out USDA-funded research in multiple North Alabama watersheds including those in the Sipsey Fork and Wheeler Basins. We work with partners including the Madison County Soil and Water Conservation District, Natural Resources Conservation Service, Alabama Cooperative Extension, Alabama Department of Environmental Management, US Forest Service, Top of Alabama Regional Council of Governments, and the Birmingham Water Works Board. These partnerships and research projects allow AAMU to participate in local watershed management decision-making processes. Student participation is an important aspect of research and watershed management goals. Underrepresented minorities have opportunities to participate in research through the Undergraduate Research and Mentoring, Research Experience for Undergraduates, Upward Bound, and biweekly student worker programs. Details of research, education, and outreach activities will be discussed.

Keywords: Minority; Watershed Management; Research; Education; Outreach

Drainage: Wheeler

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Contributed Oral

THE NAKED TRUTH: THE AFFECTS OF A LOW-HEAD DAM ON THE POPULATION GENETIC
STRUCTURE OF THE NAKED SAND DARTER (*AMMOCRYPTA BEANII*) IN THE PEARL
RIVER, LOUISIANA

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Anthropogenic modifications to aquatic habitats, such as dams, can fragment lotic systems, disrupting fluvial continuity and modify flow patterns. Such structures could negatively impact riverine ecology and potentially act as barriers to gene flow. Although previous studies have examined correlations between population declines and aquatic infrastructures, most have focused on large species of fish that are highly vagile and have low habitat specificity. The overall goal of the study is to assess the impacts of low head dams on genetic structure of stream fishes (Etheostomine darters) in the Pearl River basin. We examined genetic variation of the naked sand darter, *Ammocrypta beanii*, within the Pearl River basin using eight microsatellite loci. Specimens were also analyzed from three control sites in the Lake Pontchartrain basin. A minimum of thirty specimens were sampled from a total of twelve sites across both basins. Preliminary results suggest that there are distinct differences above and below the two low head dams (Pools Bluff and Bogue Chitto Sills) in the Pearl River basin. The implications of these results and a comprehensive summary of this data will be presented. Future work includes the addition of other stream species, which will provide additional data for a more comprehensive understanding of the long term impacts of dams on aquatic species.

Keywords: darters; population genetics; microsatellites; dams; Pearl River

Student Award: Yes

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Contributed Oral

DIET BREADTH AND OVERLAP AMONG FISHES IN AN INTERMITTENT HEADWATER STREAM

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Streams characterized by highly variable hydrology have fewer species of fish that are uniquely adapted to move in response to changing conditions or to tolerate extremes in abiotic conditions. Many streams in the eastern Ozark Highlands are characterized by spring fed headwaters that have connected pools in the upper reach and isolated pools in the mid-reach before becoming perennial. In the isolated pools both abiotic and biotic interactions may strongly shape the community composition. There are many studies showing effects of intermittency on fish populations, but few have examined affects of food availability, or diet breadth of a fish species. Headwater streams in this region are characterized by a fish assemblage comprised primarily of cyprinids and percids. Strong abiotic variation occurs with significantly lower dissolved oxygen and pH in isolated pools compared to connected pools ($p < .001$ and $p = .001$ respectively), and significantly higher conductivity and temperature in summer ($p < .001$ and $p = .03$ respectively). Sampling was conducted during March, June and August 2011. The objective of this study was to examine the effects of pool isolation on diet breadth and overlap within and among the dominant fishes in the stream. To assess this question, we collected total available macroinvertebrate prey (9 orders; 45 families) and ten of each target fish (*Chrosomus erythrogaster*, *Semotilus atromaculatus*, and *Etheostoma spectabile*) from a minimum of three pools for gut analysis in both isolated and connected pools on a headwater tributary of Sylamore Creek. Non-metric multidimensional scaling (NMS), Index of Relative Importance, Levin's niche breadth measure, and Pianka's niche overlap was used to analyze the data and will be presented to show a comparison between isolated and connected pools.

Keywords: Diet Breadth; Diet overlap; Intermittency

Drainage: White River

Student Award: Yes

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Contributed Oral

SPATIAL SCALE EFFECTS ON HABITAT ASSOCIATIONS OF THE ASHY DARTER,
ETHEOSTOMA CINEREUM

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The ashy darter, *Etheostoma cinereum*, is an imperiled benthic fish within the Cumberland and Tennessee rivers of the southeast United States. Understanding habitat use and the spatial patterns across multiple scales is a critical element of species conservation. Our objectives were to quantify habitat associations at the stream reach and microhabitat scales for adult and juvenile ashy darters, and to understand the linkage between the two scales based a gradient of habitat use. We focused our efforts within the Rockcastle River, Kentucky. Three hundred sixty-five individuals were collected from 23 sites. The ashy darter was restricted to the mainstem of the river and lower reaches of the major tributaries. The distribution and abundance of adults and juveniles darters differed significantly at the stream reach and microhabitat scales, and both groups showed non-random use of the available habitat. Stream size and proportion of large boulders (>0.5 m) at the stream reach scale were identified as important variables. The outside bend of the channel (erosional zone), boulder and gravel composition, and boulder size were important variables at the microhabitat scale. Based on the suite of environmental variables associated with *E. cinereum* at microhabitat and reach scales, it appears that a sufficient network of suitable microhabitats is needed within a stream reach to support a strong population of darters. Assessing the habitat associations across multiple scales provided a framework to explain *E. cinereum* distribution across its range and provides resource managers with the appropriate knowledge to guide conservation efforts, such as critical habitat protection or stream restoration.

Keywords: habitat use; multi-scale; conservation;
Drainage: Cumberland
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Contributed Oral

THE PIGEON RIVER RECOVERY PROJECT: INCREASING AQUATIC DIVERSITY THROUGH PARTNERSHIPS

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In 2001, a cooperative effort was begun to restore native fish populations to the Pigeon River, once so polluted that all mollusks and many fish species were extirpated. Volunteers from federal and state agencies, industry, and private organizations initiated the Pigeon River Recovery Project to begin re-introduction of fish and other aquatic species. Early successes in TN led to the expansion of the project into western NC. Since the project initiation, more than 29,000 individuals, representing 20 species of fish, and 220,000 snails (6 species) collected from French Broad basin streams and the upper reaches of the Pigeon River, have been re-introduced into the Pigeon River at selected sites in TN and NC. The first TN candidates were the gilt, bluebreast and blueside darters, followed by the stripetail darter in 2003. Reproduction was first documented in gilt darters in 2003. Monitoring surveys over the past six years have documented gilt, bluebreast, and stripetail darters, mountain madtom, stargazing minnow, and mountain brook lamprey in the Pigeon River, TN. Surveys of the lower Pigeon River documented gilt darters in nearly every riffle; this species appears to be re-colonizing the lower Pigeon River. Nine species have been transplanted into the NC segment; four shiners (mirror, telescope, Tennessee, and silver) and two darters. Both the gilt and banded darters have been collected during monitoring efforts in 2011. As of 2011, silver and Tennessee shiners have re-established populations in a 20-mile reach in NC, and gilts, stripetails, and mountain brook lampreys have established in TN.

Keywords: Pigeon River Recovery Project; reintroductions; native species; stream restoration; gilt darter

Drainage: French Broad River

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Contributed Oral

HABITAT UTILIZATION BENCHMARKS OF BENTHIC FISH IN THE PIGEON RIVER RESTORATION

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The Pigeon River of Tennessee and North Carolina was severely compromised due to anthropogenic alteration, which led to the extirpation of species. While efforts to restore fish and gastropod communities have been successful for some species (*Notropis photogenis*, *Percina evides*, *Leptoxis* sp.), success for others has been limited (*Etheostoma zonale*) to non-existent (*E. jessiae*). To better understand variation in reintroduction success, we developed quantitative models of habitat use for benthic fish species in the Pigeon River and four neighboring streams as reference sites. We sampled two riffles in the Pigeon and five riffles in reference streams during May 2011. Pigeon sites were selected on the basis of anthropogenic alteration, one close to a pollution outfall and another below a large hydroelectric dam. To analyze our data we used PCA to visualize differences in habitat availability across sites and used CCA to examine the community relationships between 18 benthic species in reference to flow, depth, and substrate composition. Our analysis of habitat availability among Pigeon sites demonstrates the outfall riffle is not habitat limited, and that the dam-influenced riffle is sediment starved; both factors may diminish site suitability for successful reintroduction. Our analysis of microhabitat relationships at reference sites suggests that *Percina* species are associated with deep sections in riffles; subgenus *Nothonotus* are associated with cobbles and higher flow, and species such as *E. zonale* and *E. swannanoa* are associated with smaller particle sizes. By comparing fish density distributions at Pigeon and non-Pigeon sites, we found that *E. blennioides*, *E. rufilineatum* and *Cottus caroliniae* use a significantly broader range of substrate types in the Pigeon compared to Non-Pigeon sites. We used a Local Mean Estimator statistical technique for this analysis. We are hopeful these insights will better inform future introduction efforts by more specifically determining release site suitability.

Keywords: Benthic; Habitat; Darter; Pigeon; Tennessee

Drainage: Upper Tennessee River

Student Award: Yes

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Contributed Oral

THE ROLE OF SPAWNING MODE IN FISH ASSEMBLAGE SHIFTS: WATER AVAILABILITY AND RECRUITMENT SUCCESS

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Water availability has decreased in many watersheds for a host of reasons, including alteration in land use and an increase in water usage. Factors that alter the hydrology of watersheds can decrease water persistence in aquatic systems. Although aquatic organisms were historically exposed to periods of drought, and conversely, high water – prolonged drought can alter fish assemblage structure for long periods of time, and perhaps permanently. Our data for Uchee Creek, a large tributary to the Chattahoochee River in east-central Alabama, suggests homogenization of the fish fauna throughout much of the stream. In this study, we explore the role of land use and spawning mode as catalysts for this faunal change. Analysis of land use layers from 1992, 2001, and 2011 in ArcGIS have shown that there has been a steady increase in urban and agricultural land use over time in the study area. Furthermore, forested sites have shifted from mixed hardwoods to pine monoculture. Watersheds with high percentages of pine monoculture have less water available in soils, which decreases seepage into streams. Stream sites in areas with the least land use change from the historic mixed hardwood forest use have maintained their fish assemblage integrity better than more impacted sites. Since some species have spawning modes that require high water discharge, while others are most successful during low flow periods, we explore the relationship between species spawning modes, water availability and persistence in Uchee Creek. Our data suggest that this correlation may help explain the success of sunfishes and decrease in native minnow species throughout this watershed.

Keywords: spawning mode, water availability, recruitment, land use

Drainage: Chattahoochee

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Contributed Oral

PHYLOGEOGRAPHY OF THE *COTTOGASTER* (*PERCINA COPELANDI* SP. CLADE)

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The subgenus *Cottogaster* (*Percina*) comprises the channel darter (*Percina copelandi*), the pearl darter (*Percina aurora*), and the coal darter (*Percina breviceuda*). The *Cottogaster* is an imperiled group of fishes experiencing extirpation and population declines throughout their range, yet no federal protection exists for any member of the clade. The channel darter maintains disjunct populations in the Mississippi Basin, occurring in the Great Lakes region of the U.S. and Canada, the Ohio River, the upper Cumberland and Tennessee Rivers east of the Mississippi Valley, and from the Red, Ouachita and Arkansas Rivers west of the Mississippi Valley. The pearl darter (one of the SFC “desperate dozen”), is described from the Pearl and Pascagoula River drainages of the Gulf coastal plain; however, it is recognized as extirpated from the Pearl River drainage. The coal darter occurs primarily above the fall zone in the Black Warrior, Cahaba and Coosa Rivers of the Mobile Basin. Our phylogenetic analysis of cytochrome b (1057 base pairs) supports currently recognized species level status among the *Cottogaster*, with a sister species relationship between *P. aurora* and *P. breviceuda*. *Percina copelandi* was polytypic in all analyses, recovering two distinct clades for populations sampled. The first clade consisted of all populations assayed east of the Mississippi River (i.e. Lake Champlain, Ohio River drainage) plus northern populations west of the Mississippi River (i.e. Arkansas River drainage). The second major clade represented the two most southern drainages sampled west of the Mississippi River, the Ouachita and Red river drainages. Patterns of cytochrome b variation highlights the significance of the Gulf coastal plain theatre in the phylogeography of the *Cottogaster*, with potential affinities between *P. copelandi* from the Red and Ouachita River drainages, *P. aurora* and *P. breviceuda*.

Keywords: *Percina*, Conservation, Desperate Dozen, Phylogeography, cytochrome b

Drainage: Gulf coastal plain, Mobile Basin, Mississippi River Basin
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Contributed Oral

DEVELOPING A BASIS FOR WILDLIFE FLOW PROVISIONS IN THE FACE OF IMPENDING AND SEVERE DROUGHT

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Pervasive drought conditions in the southeastern United States have resulted in dewatering of habitats containing recreationally important, federal, and state listed species. In regulated systems such as the Savannah River, reservoir levels have declined during recurring droughts, resulting in the implementation of incremental flow reductions from large Army Corps of Engineers dams. Flow reductions in the Savannah River have dewatered Augusta Shoals with impacts to flora and fauna including the shoals spider lily (*Hymenocallis coronaria*) and robust redbreast (*Moxostoma robustum*), disconnected and gradually dewatered oxbows harboring game fishes, larval and young-of-year fishes, and the critically imperiled Savannah lilliput mussel (*Toxolasma pullus*). Flow reductions have dewatered main channel margins containing the Savannah Lilliput and a diversity of mussels and fishes. Although flow reductions are visually striking and presumed to have adverse effects on these populations, data showing actual effects of dewatering on these habitats and species are scant. In preparation for the drought and to provide an objective assessment for revision of the drought contingency plan for the Savannah River, we recently initiated several studies to numerically quantify habitat changes and identify potential impacts. Combinations of geomorphic and biological surveys demonstrate habitat impacts that are likely to affect populations of rare species. We speculate that consideration of game fish habitat impacts into the study is likely to resonate with the public, providing a more broad appeal for population sustaining flow provisions. We considered the drought flow reductions and habitat implications in the context of pre-dam flow conditions, alteration of stream habitats for navigation improvements, and future climate change scenarios. We also demonstrate that studies such as these can be implemented with relatively small budgets and in short amounts of time, but are highly useful in a management context.

Keywords: Drought, flow regulation, Savannah River, oxbow, shoal
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Contributed Oral

ASSESSING PRIMARY STRESS RESPONSES IN ALABAMA AND REDEYE BASS IN A FLOW-REGULATED SECTION OF THE TALLAPOOSA RIVER, ALABAMA.

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Overall condition of fishes can be influenced by the amount of stress experienced. Stressors, such as alteration in temperature, oxygen or hydrology, can induce acute or chronic stress. Cortisol response is a good indicator of acute stress, but when fish are exposed to long-term or chronic stressors it is possible that there is a depression in the Hypothalamus-Pituitary-Inter-renal (HPI) axis due to hyperactivity of the system. Additional measurements of stress include leukocyte profiles, where the heterophils: lymphocyte ratio is altered when an animal is stressed. In this study we are investigating whether the HPI axis is affected in Alabama and Redeye Bass due to hydro-peaking operations at Harris Dam on the Tallapoosa River. Fish will be collected in fall 2011, by boom-mounted electrofishing boat (15 Alabama Bass) and hook and line (10 Redeye Bass) on the Tallapoosa River and a control site on Hillabee Creek, which is an unregulated tributary. Once collected, fish will be first floy-tagged and then plasma will be collected from the caudal vein within five minutes of capture. Fish will then be transferred to a 113.5-L tub where the density will not exceed 50g/L. Fish will remain in the tubs for a 1 h with plasma sampling occurring after 30 m and 1 h of confinement. This confinement is expected to trigger the stress response in the HPI axis and cortisol concentrations should rise. The blood samples will be used in assaying the plasma cortisol level and to create blood smears for leukocyte profiles. We hope to determine whether or not fish exposed to highly variable flows are still capable of reacting and responding to an acute stressor such as confinement. If the treatment fish are incapable of reacting to the acute stressor then most likely the inability is associated with a chronic stressor.

Keywords: Hydro-peaking; stress; confinement; cortisol; leukocyte

Drainage: Tallapoosa River

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Contributed Oral

LEGACY DISTURBANCES AND RESTORATION POTENTIAL OF COASTAL PLAIN STREAMS

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Stream restoration and enhancement provides opportunity to correct or improve previous alterations that have destroyed, diminished, or impaired the character and function of stream systems. The Savannah River Site (SRS), a National Environmental Research Park operated by the Department of Energy, provides an ideal research opportunity for restoration of coastal plain streams. The temporal range of disturbances to SRS streams span the range of pre-SRS legacy impacts through the early infrastructure development in the early 1950s to more recent and current industrial activities. In a collaborative effort, a multiphase program has been established to characterize SRS streams, identify risks of legacy and recent disturbances, and identify disturbed stream reaches with potential for restoration. Three levels of assessments increase in detail with each level. A Level I assessment involves a broad scale survey of potential stream disturbances and stream basin characterization. Our surveys are identifying streams that represent broad disturbance gradients in severity and time since disturbance. Least disturbed streams are critical to establish an endpoint model system. We are also identifying drainage basins where contiguous high-quality watersheds could be established. Hydrology, including outfall and runoff routes, are being mapped. Disturbances are being placed into a temporal context to establish whether of pre-SRS or SRS origins. A series of basin and valley characteristics are being measured for each tributary basin. Phase II, initiated in 2010, is assessing the effects of stream alterations in a subset of Phase I identified streams. Stream hydrology, geomorphology, and habitat availability at the reach, segment and basin level are being assessed. The recently initiated Level III assessments are further evaluating a selected subset of stream reaches by measuring additional hydrology, physicochemistry, biology, and geomorphology features. This comprehensive stream evaluation will provide management options and guide prescriptions for potential restorative actions.

Keywords: coastal plain streams; stream assessment; restoration; hydrology; geographic information systems

Drainage: Savannah River

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Contributed Oral

SPRING-ADAPTED SPECIES AS A MODEL FOR UNDERSTANDING THE GENETIC
CONSEQUENCES OF AQUATIC HABITAT FRAGMENTATION

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As aquatic species' distributions become increasingly fragmented due to habitat destruction and alteration, there is an urgency to better understand the genetic consequences associated with these actions. Our previous work has shown that most spring-adapted darters (Percidae: *Etheostoma*) have island-like distributions, with naturally low genetic diversity, high population structure, and low migration capabilities. Because of these characteristics, we hypothesize that spring-adapted darter species should serve as exceptional models to better understand the effects of habitat fragmentation on the genetic composition of other darters and stream fishes. To assess this hypothesis, we used microsatellite (m) DNA to compare levels of genetic diversity, dispersal ability, and gene flow among common stream inhabiting darters, imperiled stream inhabiting darters, and spring-adapted darters. Results from the mDNA revealed an overall significant difference among the three groups in allelic diversity (A , $P < 0.01$) and expected heterozygosity (H_e , $P < 0.01$). Pairwise comparisons revealed no significant differences between imperiled and spring darters (A , $P = 0.56$; H_e , $P = 0.61$), while common darters were different from spring darters (A , $P < 0.001$; H_e , $P < 0.001$), and marginally different from imperiled darters (A , $P = 0.095$; H_e , $P = 0.052$). Overall, our results revealed several similarities in the genetic composition of imperiled stream inhabiting darters and spring-adapted darters. Although both share low genetic diversity, thus reduced evolutionary potential, imperiled stream inhabitants do not have the luxury of stable spring habitats, rendering them more susceptible to local extirpation.

Keywords: fragmentation; darters; microsatellites; allelic diversity; heterozygosity

Student Award: Yes

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Contributed Oral

BIODIVERSITY AND COMMUNITY BIOMASS STABILITY OF STREAM FISH COMMUNITIES

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Anthropogenic influences have disproportionately affected freshwater ecosystems, and a loss of biodiversity is forecasted to greatly reduce ecosystem function and services. Loss of species may destabilize communities by limiting the stabilizing forces of compensatory dynamics and/or statistical averaging, both of which are effects that can buffer variation in aggregate community properties. Currently, support for positive diversity-stability relationships stems from experiments with simple communities at small spatial and temporal scales, and application to natural communities is limited. Using a long-term dataset of 35 stream fish communities matched with hydrologic data, we show that community stability (annual variation of standing biomass of fishes) was less variable in more species-rich communities and was not associated with stream hydrology. Only the statistical averaging model of community stability was consistent with observed patterns of lower biomass variation in more species-rich communities. Our findings suggest anthropogenically induced extirpation of vertebrate consumers may lower community biomass stability in complex ecosystems.

Keywords: population dynamics, stream hydrology, species richness, fish conservation, long-term data

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Contributed Oral

MOLECULAR EVIDENCE OF PRE-PLEISTOCENE DIVERGENCE OF THE GENUS
SEMOTILUS AS WELL AS THE PRESENCE OF CRYPTIC EVOLUTIONARY LINEAGES
WITHIN *SEMOTILUS ATROMACULATUS*

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It is generally thought that major geological and climatic events have shaped the diversity of eastern North American (eNA) stream fish assemblages. Little work has been done, however, to determine the extent to which different factors have promoted or constrained evolutionary diversification of eNA fishes. Doing so requires hierarchical comparisons of diversity within and among species across vast geographies. In this study, we examined the distribution of genetic variation within *Semotilus*, a genus that includes several widely distributed species of stream fish in eNA, to better understand the relative importance of glaciation, fluctuations in sea level, and the rise of the Appalachian Mountain and Central Highlands. We first constructed a genus-wide molecular phylogeny of *Semotilus* to identify and describe the distribution of evolutionary lineages across eNA. We also reconstructed range-wide patterns of phylogeographic structure within *Semotilus atromaculatus* to better understand how geologically recent (i.e. Pleistocene) and older events have contributed to diversification of the genus. Not only did we recover several cryptic lineages that warrant species recognition, we found evidence suggesting that the center of diversification rests in the southern Appalachian highlands. Diversification of the genus also appears to correspond to events predating the Pleistocene, but the distribution of genetic variation within species appears to reflect more recent events. Similarly structured approaches encompassing other broadly distributed groups could offer further insight into the evolutionary origins of eNA freshwater fish diversity.

Keywords: *Semotilus*; phylogeographic; evolutionary lineages

Student Award: Yes

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Contributed Oral

POTENTIAL FOR NATIVE FISH AS A VECTOR FOR DISPERSAL OF TWO INVASIVE
BIVALVE SPECIES

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The introduction and spread of invasive species is of great concern to natural resource managers in the United States and biologists must be aware of the multitude of dispersal methods used by these organisms. We investigated the potential for survival of zebra mussel (*Dreissena polymorpha*) and Asian clam (*Corbicula fluminea*) through the gut of a native North American migrating fish (blue catfish, *Ictalurus furcatus*) as a dispersal mechanism for these invasive bivalves. Blue catfish are particularly likely to facilitate their spread because they forage on mussels and lack molariform pharyngeal teeth required to crush shells. Blue catfish (N=57) sampled from Sooner Lake, Oklahoma, were transported to a wet laboratory and placed into individual tanks. After 48 hours, fish were removed and all fecal material was collected and inspected for live mussels. Forty percent of all sampled fish had consumed some quantity of mussels. We found that 12% of the 933 zebra mussels recovered and 39% of the 408 *Corbicula* recovered were alive at water temperatures below 21° C. These estimates are likely conservative because empty shells may have been consumed during their non-selective foraging, violating our assumption that all recovered mussels were alive when ingested. As a result, we believe that survival through the gut of blue catfish can be an effective dispersal method for these invasive bivalve species.

Keywords: invasive species; dispersal mechanisms; blue catfish (*Ictalurus furcatus*); Asian clam (*Corbicula fluminea*); zebra mussel (*Dreissena polymorpha*)

Student Award: Yes
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Contributed Oral

PATTERNS OF SHAPE AND SIZE VARIATION IN THE BLACKTAIL SHINER (*CYPRINELLA VENUSTA*) CORRELATED WITH STREAMFLOW

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Environmental gradients often lead to the parallel evolution of populations and species. We used blacktail shiners (*Cyprinella venusta*) to examine the parallel and independent (sex-specific) aspects of population divergence in response to water flow. Geometric morphometrics was used to analyze size variation and shape variation for blacktail shiners from twelve sites in river systems along the northern Gulf of Mexico from eastern Texas to eastern Alabama. Body size showed strong parallel population divergence; both sexes were larger at sites with lower water velocity (smaller cumulative drainage area). Body shape showed a mixture of parallel and independent population divergence. The strongest and most consistent effect was that low-flow (low cumulative drainage area) sites had males and females with more elongate heads, shallower and longer caudal peduncles, shorter anal fin bases, and more slender bodies overall. One or more of these morphological differences may have adaptive significance related to swimming performance.

Keywords: *Cyprinella*; stream flow; body shape

Student Award: Yes

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Contributed Oral

PERSISTENCE OF FISH ASSEMBLAGES ON SAND AND GRAVEL BAR HABITAT IN THE
ALABAMA RIVER, ALABAMA

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The Alabama River is a biologically diverse system containing over 180 native fishes and at least 33 endemics. Many studies have surveyed species of conservation concern, such as the critically imperiled Alabama Sturgeon (*Scaphirhynchus suttkusi*), Alabama Shad (*Alosa alabamae*), and Crystal Darter (*Crystallaria asprella*), but few document entire fish assemblages. Data on entire fish assemblages are critical for understanding and detecting faunal changes, including homogenization, however. This study surveys fish assemblages of sandbar habitat in the lower Alabama River and 9 associated tributaries. Diel and seasonal surveys were conducted along 19 sandbars from Dixie Landing (river mile 22) to Claiborne Lock and Dam (river mile 72). A total of 55 species were recorded in 44 collections during summer, fall, and spring 2010 – 2011. One species of conservation concern, Crystal Darter (*Crystallaria asprella*), was detected during our survey (n=34). Fish assemblages in tributaries contained darter and minnow species not detected in our sandbar collections and clupeid species detected in sandbar samples were absent from tributary collections. Similarity indices were used to compare our data to historical data in order to detect assemblage changes over time. Our samples had low similarity to historical samples of R.D. Suttkus and the Geological Survey of Alabama, suggesting long term fish assemblage shifts. Diel comparisons indicate low similarity reflecting large numbers of catfish species detected mostly in night collections. Data also show seasonal faunal changes among sandbar fish assemblages. In 2010 we detected extremely high numbers of a distributional record, Gulf Menhaden (*Brevoortia patronus*) during summer and fall collections, however no Gulf Menhaden were detected during spring 2011 samples. Finally, sandbar area varied from 0.5 - 64.7 acres. Correlation and regression analysis indicate no significant relationship between sandbar proximity or area and species richness, however we suggest ongoing anthropogenic disturbances such as dredging may affect richness among these sites.

Keywords: fish assemblage; Menhaden; diel; spatial variation

Drainage: Alabama River

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Contributed Oral

INTER-SEASONAL MOVEMENTS OF ETHEOSTOMATINAE DARTERS IN YELLOW CREEK
AND WHITEOAK CREEK, TENNESSEE

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Although movements of some fishes have been extensively studied, limited focus has been given to small, non-game fishes. Previous studies have demonstrated the need for more research incorporating multiple scales, taxa, and life histories to provide better insight into the movements of darters. Whiteoak Creek (Tennessee R.) and Yellow Creek (Cumberland R.) are found on the Western Highland Rim of middle Tennessee. Darters were collected from four consecutive riffles in each of these two streams and given riffle- and season-specific, fluorescent, visible-implant elastomer (VIE) marks starting in February 2011. A total of 6,891 darters (12 species) were marked across pre-spawning, spawning, and post-spawning collections. Of these, 264 (3.83%) (7 species) have been recaptured with three recaptured during both re-capture attempts. Sixty-six (25.2%) of the recaptured fish had moved to another riffle. The mean distance traveled was 262.8 m ($\sigma = 299.6$). A significant difference in the number of fish that had moved was seen among species ($p = 0.0042$), but not between sexes ($p = 0.395$). A linear regression shows significant positive correlation between total distance moved and maximum pool depth ($p < 0.0001$), riffle area stability ($p = 0.0033$), and average pool width ($p = 0.0156$), and a significant negative correlation between total distance moved and average pool depth ($p < 0.0001$) and congeneric density ($p = 0.0041$). All other life history, ecological, and individual variables were not significant. No directional bias has been observed ($p = 0.109$). Understanding of a species and its life history is essential to the development and implementation of conservation practices. Although limited in its ability to detect long-range movements, this study supports the assumption that most darters likely have a small home range, but the inclination or ability to disperse may vary among species and be dependent on certain ecological variables.

Keywords: Darters; movement; life histories

Student Award: Yes

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Contributed Oral

THE EFFECT OF NOISE ON BEHAVIOR AND ACOUSTIC COMMUNICATION IN THE
BLACKTAIL SHINER (*CYPRINELLA VENUSTA*)

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Despite their seemingly quiet underwater habitat, freshwater fishes are not sheltered from elevated noise levels. Anthropogenic noise, along with natural noise sources including other organisms, waterfalls, rainfall, and water turbulence all increase noise levels in an aquatic environment. Higher noise levels can result in elevated hearing thresholds, and decrease the signal-to-noise ratio of acoustic signals. Because many fishes use acoustic signals during critical life history stages (such as reproduction and territory defense), it is important to determine whether elevated noise levels affect behavior or sound production during these stages. This study provides the first description of the relationship between sound production, hearing, natural environmental noise, and sources of anthropogenic noise for *Cyprinella venusta*, a small, vocal fish commonly found in small streams of the southeast United States. The effect of noise on the active area was calculated under both natural and anthropogenic noise sources, and was used as a measure of disturbance by anthropogenic noise sources. A follow up study was performed to determine whether elevated ambient noise levels affect sound characteristics and behaviors of *C. venusta*. This study was performed in the laboratory, where *C. venusta* sounds and behaviors were recorded under both quiet and noisy conditions. Signals and behaviors produced under both noise regimes were compared to determine whether fishes altered their sounds or behaviors. Of particular interest were behavioral or sound modifications that would suggest an attempt to compensate for a decrease in active area of acoustic signals. This work helps move towards a more holistic understanding of the relationship between many freshwater fishes and their environment. Further research in this area should be pursued, and may uncover important relationships between habitat suitability and soundscape which are not of yet fully understood.

Keywords: anthropogenic; cyprinid; hearing; noise; sound
Drainage: Chattahoochee River
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Contributed Oral

VARIATION IN THE TOMBIGBEE DARTER (*ETHEOSTOMA LACHNERI*) SPECIES COMPLEX

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The Tombigbee Darter is a member of the subgenus *Ulocentra*. Members of this subgenus are commonly referred to as snubnose darters and the males are remarkable for their bright coloration during spawning season. These fishes are distributed throughout the southeastern United States and generally prefer small to medium sized streams. The snubnose darters are a diverse group with additional species still being described in recent literature. Tombigbee Darters are found throughout the Tombigbee River drainage preferring small streams with slow to moderate current. While most populations are found below the Fall Line in lowland habitats there are several populations in the upper portions of the Sipsey River which occur above the Fall Line in upland habitats. Previous researchers have anecdotally noted some differences in breeding male coloration and color pattern between populations of *E. lachneri* found in different physiographic provinces. In this study we investigate the genetic, morphological, and meristic variation between the upland and lowland populations of the Tombigbee Darter. Molecular mitochondrial ND2 sequence data show as much as 3.6% sequence divergence between upland and lowland populations. General body shape differences include the upland populations having shorter, stouter bodies while the lowland populations have longer, more slender bodies. Differences in male breeding coloration include a complete red band in the second dorsal fin in upland populations versus a red band covering only the posterior half of the second dorsal fin in the lowland populations. Upland populations have red pigment above the lateral line instead of orange in lowland populations.

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Contributed Oral

SAMPLING STREAM FISH COMMUNITIES: AN APPROACH TO IMPROVE SPECIES
DETECTION, ESTIMATE SPECIES RICHNESS, AND RELIABLY DETERMINE TREND
THROUGH TIME.

Robert A. Hrabik

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Field Station

Stream fish populations have long been sampled. However, tracking biodiversity through time has been problematic but can be improved if we begin to explore sampling designs that characterize fish communities with precision. The commonly used biodiversity index, Shannon's H' , requires that the number and abundance of species within the community be known. The only way to absolutely know species richness and abundance is to count every fish, an impossible task in most situations. So, sampling designs must be used in which one can estimate species richness and abundance. In this presentation we use data collected from aquatic habitats in Mingo National Wildlife Refuge where we are examining the possible effects of reintroduced Alligator Gar on species richness through time. Using a multiple-gear approach, we developed a "capture history" of each species and estimated species richness, sampling error, and confidence limits using the computer program CAPTURE. We modified CAPTURE by simply substituting gear type for capture occasion in the capture history matrix. CAPTURE uses the capture history matrix to compute several models that can be compared to what the investigator observes in nature. Using statistically based estimates that account for variation in capture probabilities of species under different conditions through time will provide the investigator with a measure of change in the fish community along with a measure of precision of these estimates.

Keywords: community; species richness; biodiversity; abundance; estimation
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Contributed Oral

ENVIRONMENTAL ACOUSTIC CUES SUGGEST EXPLANATION FOR HEARING
SPECIALIZATION IN CYPRINIDAE.

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Fishes in the superorder Ostariophysi have excellent hearing due to the presence of a synapomorphic hearing specialization called the Weberian apparatus. This structure connects the swim bladder to the inner ear, and increases both sensitivity and upper hearing range. Although numerous experiments have tested the effects of the Weberian apparatus on hearing, few provide evidence supporting a reason that these fishes have the specialization. We conducted a field based experiment in which a rock shuffling noise and a white noise were played simultaneously from adjacent speakers in a clear, mountain stream in the southern Appalachian Mountains, USA. Our results indicate that species of Cyprinidae, a family within Ostariophysi, were attracted more to rock shuffling noise than to the white noise. This study provides the first evidence that a broadband environmental sound associated with a potential food source is utilized by a potentially large number of species possessing a hearing specialization.

Keywords: minnows, sounds

Drainage: Tennessee

Contributed Oral

RATES OF HYBRIDIZATION, INTROGRESSION, AND FORMATION OF CHIMAERIC
LINEAGES IN DARTERS.

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Ecology and Evolutionary Biology and Yale Peabody Museum of Natural History

It is currently accepted that hybridization and introgression can influence the evolutionary trajectory of a lineage and affect patterns of diversification. Whether it is the capture of a heterospecific mitochondrial genome or the formation of a chimaeric (or hybrid) lineage with a mosaic genome, the novel combination of genetic material may allow an organism to exploit a novel environment. However, the rates at which hybridization, introgression, and formation of chimaeric lineages occur in nature are not often investigated in a phylogenetic framework. Darters are an excellent group in which to study these rates, because they are one of the most well researched clades of North American freshwater fishes. There are published studies on the number of darter species that hybridize (~25%), that have experienced some extent of introgression (~12.5%), and we have identified at least one chimaeric lineage (representing ~0.004% of darter species). Additionally, a recently published explicit phylogenetic hypothesis for 98.8% of darter species that is time calibrated allows the examination of these rates in a phylogenetic context.

Keywords: Percidae, Carnipellucida, Etheostoma, Nothonotus, Percina
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Contributed Oral

RESPONSE OF A FISH COMMUNITY TO STREAM RESTORATION AFTER A COAL SLURRY
SPILL IN A TRIBUTARY TO THE NORTH RIVER (BLACK WARRIOR RIVER DRAINAGE,
MOBILE BASIN) IN ALABAMA

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In July 2011 a maximum of 600,000 gallons of coal slurry accidentally spilled into an unnamed tributary of Freeman Creek, Alabama, a tributary to the North River (Black Warrior River drainage, Mobile Basin). Multiple rock filter dams and other devices were installed on Freeman Creek to contain and capture slurry fines to limit impacts to the North River, which is critical habitat for five federally listed species of mussels. A major rain event hampered containment efforts, but additional filter dams installed on lower Freeman Creek and manual cleanup efforts at the spill site and in the stream bed and surrounding banks and bars in the unnamed tributary continued to mitigate effects. Immediate impacts on fishes and other aquatic taxa in the unnamed tributary and Freeman Creek in downstream areas 5 and 10 days after the spill included loss of diversity and abundance, especially benthic taxa such as darters (Percidae). There were no apparent short-term impacts on aquatic taxa in the North River. In response to restoration efforts in the unnamed tributary and the natural flushing of slurry from the upper impacted reaches of Freeman Creek, diversity and abundance of fishes have increased. Sampling for fishes and other aquatic taxa will continue to assess recovery of aquatic biota in response to continuing cleanup efforts in Freeman Creek.

Keywords: coal slurry; restoration; fish community; North River; critical habitat

Drainage: Black Warrior River

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Contributed Oral

EVALUATION OF SHOAL BASS RESTORATION-STOCKING IN A CHATTAHOOCHEE RIVER TAILWATER

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In 2003, the Georgia Department of Natural Resources and the National Park Service initiated a five-year shoal bass stocking program below Morgan Falls Dam in the Chattahoochee River, Georgia to re-establish a population to historic numbers and to provide further sport-fishing opportunities. Shoal bass were marked with oxytetracycline and stocked as juveniles (25-74 mm TL) in spring (April-June) each year. Contribution to the adult population was evaluated by collecting adult shoal bass in 2007 through 2011 and viewing their otoliths for presence of an OTC mark. Multiple stepwise regression was used to evaluate how mean length at stocking, mean seasonal river flow, and mean seasonal river temperature affected recruitment of stocked fish to adulthood. Stocked shoal bass dominated the total sample of adult fish collected (60%), and most of these fish were stocked at a larger size. Based on results from multiple regression modeling, age-3 shoal bass abundance was positively related to mean size at stocking and spring water temperatures. Shoal bass in this population exhibited low mortality (20%), high longevity (14 years), and low growth rates. Overall, the five-year shoal bass stocking program was successful in increasing shoal bass abundance below Morgan Falls Dam and results indicated that stocking larger fingerlings during late spring resulted in higher recruitment.

Keywords: age, growth, mortality, Buford Dam, Morgan Falls Dam
Drainage: Chattahoochee River
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Contributed Oral

THE UTILIZATION OF NATURAL HISTORY COLLECTION DATA FOR THE ASSESSMENT OF SPECIES POPULATION TRENDS: A CASE STUDY INVOLVING LOUISIANA'S RARE FRESHWATER FISHES

Justin Mann
Tulane University Museum of Natural History

Establishing conservation priorities within aquatic habitats in Louisiana has been difficult due to an overall lack of available ecological and biological information. Natural history collection computerization and networking efforts are giving researchers unprecedented access to the wealth of species occurrence and abundance data found in those collections. The Louisiana Natural Heritage Program lists 28 species of fish as rare in Louisiana, without any quantitative analysis of population trends or threats. The goal of this study is to demonstrate the utility of data in biological collections for assessing occurrence and abundance trends in these species. We use historical catch data harvested from Fishnet2 to determine if 20 of the 28 listed species are actually showing signs of declines. The species studied were chosen for their primarily freshwater nature, their lack of any research aimed at status assessment within the last 10 to 15 years, as well as the consistency of available data. Data were only deemed "available" after extensive cleaning, and refinement. This included name consolidation, exclusion of inappropriate data, and time period truncation. A Mann-Kendall trend analysis was performed on mean annual abundances to identify collection trends over time. Multiple probabilistic models were used to infer threat, including the Solow equation (Solow 1993), a modified version of the Solow equation (McCarthy 1997) which accounts for collection effort, and a non-parametric version (Solow and Roberts 2003). For the Solow equation 9 of the 20 species had p values that indicated significant threat. The partial Solow indicated that 13 species were significantly threatened. As was the case with the Mann-Kendall analysis, 13 species had significant downward trends. The results underscore the value of natural history collection data for assessing species imperilment.

Keywords: Conservation; Louisiana; Natural History; Fishnet2; Population Trend

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Contributed Oral

SNORKEL BREAK: SNEAK PEAKS AT A FORTHCOMING FILM ON SOUTHEASTERN
AQUATIC BIODIVERSITY

Jeremy Monroe
Freshwaters Illustrated

Despite the unique diversity of fishes and aquatic life in rivers and streams of the Southeast, the fauna of these waters have been scarcely covered in popular media and imagery. This presentation will include sneak peaks at imagery and stories we are capturing as part of an educational film and media project on Southeastern Rivers. I will also present a new online resource where much of this imagery can be archived and accessed and used in education, outreach, and social media.

Keywords: *Fundulus notatus*; *Fundulus olivaceus*; contact zone; feeding; diet; syntopic and allotopic

Drainage: Photos; Video; Biodiversity; Education; Outreach

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Contributed Oral

RELATIONSHIPS OF GEOMORPHIC CONDITIONS AND WOODY MATERIALS IN COASTAL PLAIN STREAMS

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Geomorphic conditions in natural streambeds are extremely complex with several physical attributes that directly impact the dimensions, pattern, and profile of the river channel. For streams of the coastal plain, in-stream woody material has been a constant for millions of years, resulting in local effects on stream channel morphology as well as integrated influences on channel form and dynamics over a wide range of spatial and temporal scales. Owing to the increased flow resistance provided by the addition of large woody material (LWM) to a stream, the potential for a net increase in sediment storage, changes in bed texture, and changes in sediment transport increase substantially. Because bed texture, pool geometry, the variability of local stream flow, and LWM all affect both fish and macroinvertebrate habitat, quantifying the various processes associated with LWM in streams is important for guiding stream protection and restoration efforts. The U.S. Fish and Wildlife Service is leading this effort to gain increased knowledge of LWM in stream channels, and create new guidelines for designing natural channels and stream restoration projects. These guidelines will aid in preserving natural bankfull channel dimensions, habitat, stream channel stability and connectivity to their associated floodplains and wetlands. Data will be presented on regional LWM characteristics for coastal plain streams based on drainage area, sediment storage, slope, and entrenchment conditions. Information on LWM channel distribution, volume, density, and channel orientation will be presented as well.

Keywords: stream restoration, large woody material, stream morphology

Drainage: Escambia, Blackwater, Yellow, Choctawhatchee, Apalachicola, Ochlocknee, St.

Andrew Bay, and St. Marks

Student Award: Yes

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Contributed Oral

GENETIC MONITORING OF ESA LISTED SPECIES INHABITING CITICO AND ABRAMS CREEKS

Gregory Moyer, Ashantye Williams
USFWS

One of the most poignant examples of the wholesale loss of a fish community was that of Abrams Creek, TN. In 1957, an ichthyocide was applied to the creek in order to create a recreation trout fishery. As a result the now federally threatened yellowfin madtom, and the endangered smoky madtom and citico darter were extirpated. During mid-1980s, captive propagation and reintroduction of these species was initiated. Specifically, each was introduced from Citico Creek to Abrams Creek. Although reintroduction efforts appear demographically successful, there still could be a perceived genetic risk of extinction. Our study attempted to quantify such genetic risk by estimating and comparing levels of genetic diversity between Citico and Abrams populations for each species. Using microsatellite data, the average number of alleles and expected heterozygosity was, for all species, less than 2.6 and 0.23, respectively. For each species, Citico Creek populations had significantly more genetic diversity than that of Abrams Creek. Low levels of genetic diversity suggest that these species may have undergone a past bottleneck event. Modeling of differing evolutionary scenarios indicated that the loss of genetic diversity occurred at a minimum of 50-100 generations ago. Such populations that are small and isolate, in theory, should show limited lowered fitness upon inbreeding; thus, the risk of extinction/extirpation owing to inbreeding depression appears low. However, due the potential fixation of detrimental alleles, populations/species have an elevated risk of extinction/extirpation due to a high genetic load. Thus, the risk of extinction caused by the fixation of new mutations may be as great as those associated with demographic and environmental stochasticity. Further genetic monitoring and habitat protection should be of high priority to minimize extinction risks.

Keywords :yellowfin madtom, smoky madtom, citico darter, extinction risk

Drainage: Citico and Abrams creeks

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Contributed Oral

EVOLUTIONARY HISTORY OF DARTER SPECIES ENDEMIC TO THE CANEY FORK RIVER SYSTEM

Thomas J. Near

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At least four species of darters are endemic to the Caney Fork River System above the Great Falls, *Etheostoma etnieri* Cherry Darter, *E. forbesi* Barrens Darter, *E. basilare* Corrugated Darter, and *E. akatulo* Bluemask Darter. A dataset consisting of 14 nuclear genes was analyzed to identify the sister lineage of each of the Caney Fork endemic darter species and divergence times were estimated using both mtDNA gene trees and nuclear gene inferred species trees. The biogeographic history of each lineage was reconstructed using a maximum likelihood-based dispersal-extinction cladogenesis method. The age estimates to common ancestry, ancestral area reconstructions, and magnitude of genetic variation was compared among the Caney Fork endemic species. These comparisons indicate that each endemic lineage has a unique and idiosyncratic history of isolation and speciation within the Caney Fork System. In other words, there is not a single set of paleogeographic events that would serve as a vicariant isolating mechanism for these four disparately related Caney Fork endemic darter species.

Keywords: *Etheostoma*, biogeography, vicariance

Drainage: Caney Fork, Cumberland River

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Contributed Oral

URBAN REACHES AS DEMOGRAPHIC SINK HABITATS FOR LITHOPHILIC STREAM FISHES

Brandon K. Peoples and Emmanuel A. Frimpong
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An understanding of the spatial variation in the population structure of lotic fishes is vital to their conservation. Lithophilic (clean mineral substrate) spawners are disproportionately affected by common habitat disturbances, and are thus expected to exhibit great demographic variation along gradients of disturbance. We related age distributions of six lithophils to land cover and instream habitat variables. To encompass a broad range of lithophilic spawning modes and levels of parental care, we focused on mottled sculpin and fantail darter (lithophilic speleophils), mountain redbelly dace and rosieside dace (open broadcasters/nest associates), bluehead chub (gravel mound nester), and rock bass (saucer-pit nester). Fishes were collected from 18 urban or forested reaches of three 2nd-4th Strahler-order tributaries of the New River, Virginia. Individuals were assigned to age classes based on length-frequency histograms verified by sagittal otolith analysis. Chi-square tests and multiple polytomous logistic regression were used to relate population structure to land cover types and associated instream habitat variables. Age distributions of broadcast lithophils were unbalanced (containing higher proportions of adults than juveniles) in urban reaches, whereas those of nest-constructing spawners were always balanced. Mixed responses were observed between the two speleophils. Differences in the directional effect of urbanization on population structure are attributable to species' tendency to: a) modify available substrate and, b) to provide parental care to their brood. These results suggest that source-sink dynamics may operate to prevent populations of various fishes in urban reaches from being extirpated. For many species, urban reaches serve as demographic sink habitats that must be supplemented by surplus reproduction in more suitable source habitats. For species that utilize nest association as a reproductive strategy, the relative importance of dispersal and nest association to persistence should be further explored. Maintaining connectivity among heterogeneous habitat patches should be a goal of any lotic species' conservation strategy.

Keywords: source-sink dynamics; population structure; lithophil; urbanization

Drainage: New River, Virginia

Student Award: Yes

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Contributed Oral

(STREAM) PIRATES, RARE EARTHS, AND SPECKLED DARTERS: THE STORIED TALE OF
THE GULF OF MEXICO COASTAL PLAIN DRAINAGES

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The course of the ancestral Tennessee River has been debated in both the geological and biological literature for over 100 years. Several of the proposed courses for the ancestral Tennessee place its course across the state of Mississippi. Geochemical analysis of sedimentary rocks in the Pascagoula River basin supports these hypotheses suggesting that the rocks in the Pascagoula basin were derived from the Highland Rim of Tennessee and northern Alabama, while geochemical analysis of rocks from the Pearl River basin point to deposition from a mixture of sources including the ancestral Mississippi River and perhaps the ancestral Tennessee. To delve deeper into the history of the Tennessee River, the phylogenetic systematics of the darter subgenus *Doration* were used to further test these hypotheses. Results of the phylogenetic analyses suggest that the members of *Doration* along the Highland Rim are diverged from not only the remaining *Doration*, but also from one another due to the breaching of the Fort Payne chert atop the Nashville Dome during the Miocene. From the phylogenetic analyses, it is unclear whether the ancestral Tennessee crossed Mississippi, but a couple of patterns are evident. First, the results suggest that a stream capture event occurred between Bear Creek of the lower Tennessee drainage and one of the eastern tributaries to the Tombigbee River of the Mobile basin. Second, *Etheostoma stigmaeum* from the Pascagoula River basin are consistently recovered as monophyletic. When coupled with the geological evidence, these findings suggest that the history of Pascagoula River basin may be independent of its neighboring drainages on the coastal plain, possibly due to the mobilization of salt domes in the subsurface of the Gulf of Mexico coastal plain.

Keywords: *Doration*; *Etheostoma stigmaeum*; Rare Earth Elements; Tennessee River;
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Contributed Oral

EVIDENCE OF SOUND PRODUCTION IN THE FEDERALLY-THREATENED GULF STURGEON *ACIPENSER OXYRINCHUS DESOTOI* AND POTENTIAL IMPLICATIONS FOR CONSERVATION

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The family Acipenseridae (sturgeons) contains some of the most highly imperiled fishes of the world. Although of great interest to many researchers, surprisingly little is known about their reproductive behavior, and specifically, how they communicate. Sound production as a mechanism of communication has been documented in the Russian Sturgeon (*Acipenser gueldenstaedtii*), Pallid Sturgeon (*Scaphirhynchus albus*) and the Shovelnose Sturgeon (*Scaphirhynchus platyrhynchus*), and it is likely that all sturgeons are soniferous. We investigated sound production in the Gulf Sturgeon *Acipenser oxyrinchus desotoi* in the Suwannee River via use of remote recording devices placed in a known spawning location and in a summer resting area where large aggregations were known to occur. Acoustic signals that sounded like clicks were detected in both locations, and it is possible that several “call types” exist. Sound production was often associated with jumping behavior on the resting grounds. Also, the signals were unlike those recorded in *S. platyrhynchus* and *S. albus*, but possibly similar to those recorded in *A. gueldenstaedtii*. Determination of other signal types, geographic variation among drainages, and sound production in Atlantic sturgeon *A. oxyrinchus oxyrinchus* are being investigated. Potential implications for conservation will be discussed.

Keywords: sound production, sturgeon, behavior, conservation

Drainage: Gulf of Mexico

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Contributed Oral

POPULATION STRUCTURE OF THE IMPERILED TRISPOT DARTER, *ETHEOSTOMA TRISELLA*, IN LITTLE CANOE CREEK, COOSA RIVER DRAINAGE, MOBILE BASIN, ALABAMA

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The Trispot Darter, *Etheostoma trisella*, is a member of the subgenus *Ozarka* and is endemic to the Coosa River drainage (Mobile Basin). Members of *Ozarka* exhibit extraordinary male breeding coloration and spawn in ephemeral streams fed by spring seeps. They are vulnerable to habitat destruction and alteration because their life history strategy involves movement into ephemeral streams for spawning. *Etheostoma trisella* had been considered extirpated in Alabama because its two known localities were impounded to create two reservoirs in the mid 1900s, but was rediscovered in Alabama in 2008. A previous study showed that another member of *Ozarka* (*E. boschungii*) exhibits high levels of population genetic structuring among breeding sites within the same creek system, suggesting the possibility of breeding site fidelity. *Etheostoma trisella* resides in creeks and small rivers during the non-breeding season and must locate to ephemeral streams to spawn annually; therefore they may possess homing abilities to locate natal seep areas. In order to test if site fidelity is present in this species, microsatellite DNA data were compared between two sites within the Little Canoe Creek system in Alabama approximately 5.4 kilometers apart. Potential site fidelity was examined on a finer scale using three ephemeral seep areas within a site, with 200 to 800 meters separating the mouths of these tributaries. These data are essential for understanding the basis for genetic diversity within this imperiled species and protecting crucial spawning habitat.

Keywords: Trispot Darter; *Etheostoma trisella*; microsatellites; population genetics; breeding site fidelity

Drainage: Coosa River

Student Award: Yes

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Contributed Oral

SYSTEMATICS OF THE *ETHEOSTOMA CINEREUM* SPECIES COMPLEX.

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We examined geographic variation within the Ashy Darter, *Etheostoma cinereum* of the mitochondrially encoded cytochrome b gene (cyt b) and nuclear recombination activation gene 1 (RAG1) as well as pigmentation, 6 meristic variables, and 20 morphometric variables to discover patterns indicative of speciation within the complex. Four different geographically disjunct entities were identified by at least one of the datasets corresponding to the Cumberland, Duck, Elk, and upper Tennessee river drainages. Monophyly of cyt b and RAG1 haplotypes, modal meristic differences, moderate morphometric divergence, and unique pigmentation in specimens from the Cumberland River suggest this is a unique evolutionary species under many different species concepts. Other populations exhibit varying degrees of divergence in the different datasets and leave the evolutionary history and taxonomic status of the Duck, Elk and upper Tennessee populations unclear.

Keywords: Percidae, darter, species, Cumberland River, Tennessee River

Drainage: Cumberland, Duck and Tennessee rivers

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Contributed Oral

BEST PRACTICES FOR CAPTIVE PROPAGATION AND AUGMENTATION PROGRAMS
USING THE CONASAUGA LOGPERCH AS A CASE STUDY

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The Conasauga logperch (*Percina jenkinsi*), one of the rarest darters in North America, is restricted to 55 river km of the mainstem Conasauga River in Georgia and Tennessee. Given recent apparent population declines and its recent designation as an SFC “Desperate Dozen”, captive propagation for augmentation may be vital to prevent the species’ extinction until conservation actions targeted at their habitat are effective at mitigating recent stressors. As prior studies have noted unusually high genetic diversity within the Conasauga logperch, any propagation programs must proceed carefully to prevent disrupting this unique genetic signature in the wild. A joint study to examine genetic diversity and create a successful captive breeding program for the Conasauga logperch was initiated in 2009. Conservation Fisheries, Inc. (CFI) collected 3 adults in 2009, but they did not spawn in captivity during the 2010 breeding season. In August 2010, 13 logperch were observed in Polk Co., TN, and eight of these individuals were collected and transported back to CFI. Though two of these fish died later, likely from handling stress, 9 adults were at the facility for the 2011 captive breeding season. In 2011, CFI successfully propagated this species, producing over 700 juveniles. Preliminary genetic analysis of the broodstock and the offspring indicated that two of the broodstock were females, and all males contributed offspring, though in different proportions. The effective population size of the offspring was 5, nearly identical to that expected based on the number of males and females in the broodstock. The partners are now discussing possible sites and numbers for augmentation. Meanwhile, 16 Conasauga logperch were observed during a snorkel survey in July 2011. Further work examining the size and genetic diversity of the wild population is needed as this augmentation program moves forward.

Keywords: captive breeding; augmentation; genetic diversity; *Percina*; partnership

Drainage: Conasauga River

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Contributed Oral

FISHNET2 DECONSTRUCTED: AN OVERVIEW OF THE ARCHITECTURE AND FEATURES BEHIND THE FISHNET2 SEARCH ENGINE

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On April 22, 2010 an explosion on the British Petroleum Deepwater Horizon Oil Platform resulted in the release of large quantities of crude oil into the northern Gulf of Mexico. The ability of ecologists and other scientists to assess the impacts of the spill on the Gulf of Mexico ecosystem depends critically on the availability of baseline data on the composition and structure of biotic communities in the region under natural conditions. Natural history museums have the ability to provide much of this information as they contain data on biological resources spanning hundreds of years. The FishNet2 network is a collaborative effort among fish collections around the world to share and distribute data on specimen holdings. Over the past year a number of enhancements have been made to the FishNet2 architecture and search interface to facilitate data extraction for responding to spatially and temporally defined events such as the BP Oil Spill. Specifically, we have improved upon the data harvesting architecture, added geospatial query capabilities, improved result summaries, made significant changes to the UI and produced an API to facilitate third party integration. Additionally we have expanded the FishNet2 architecture to an instance of the HerpNet data network (i.e., HerpNet2) to evaluate deployment and applicability of this technology to other taxonomic data networks.

Keywords: FishNet, Biodiversity, Informatics
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Contributed Oral

VARIABILITY IN SPOT COUNT PHENOTYPE IN RELATION TO REPRODUCTIVE INVESTMENT, TURBIDITY AND SEXUAL SELECTION

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Understanding the mechanisms driving phenotypic variation is fundamental to evolutionary theory. Experimental systems that allow for examining or manipulating multiple drivers of phenotypic variability (natural selection, sexual selection and environmental variability) are especially valuable for tests of theory. In the *Fundulus notatus* species complex, the presence of dorsolateral spots is the lone character used to discriminate the ecologically and morphologically similar topminnows *F. olivaceus* and *F. notatus*. In studying hybrid zones among these species, we have noted substantial variability in the spot phenotype. The purpose of this study is to examine patterns of variability in the spot phenotype (spot density) across the range of this species in relation to sex, reproductive investment, mate choice, predation pressure and water clarity. Specifically, we ask 1) is spot density sexually dimorphic in *F. olivaceus*?, 2) is spot density an indicator of male reproductive condition?, 3) do males with more spots sire more offspring in mate choice trials?, 4) are males with more spots more prone to predation pressure? and 4) on a population level, does spot density correlate with water clarity?

Keywords: sexual dimorphism; phenotypic variation; mate choice; turbidity; *Fundulus*

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Contributed Oral

LIFE HISTORY OF THE REDFIN DARTER, *ETHEOSTOMA WHIPPLEI*, IN CENTRAL ARKANSAS

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Little is currently known about aspects of life history and ecology of Redfin Darter, *Etheostoma whipplei*. Long-standing taxonomic confusion with its sister taxa the Redspot Darter, *Etheostoma artesiana* may further confound our understanding of *E. whipplei*. Nearly the entire range of *E. whipplei* is potentially subject to nontraditional natural gas extraction (hydrofracking), a practice related to disturbances such as stream water withdrawal and increased siltation. Due to this potential threat we find it imperative to improve our knowledge base of *E. whipplei*. We conducted a reproductive life history survey of a population in Cypress Creek, Arkansas from June 2010 to May 2011. Gonadosomatic index (GSI) peaked in February and March at an average of 2.1 for males and March and April at an average of 12.4 for females. Reproductive season, based on presence of mature oocytes, lasts from mid-January to mid-May. Clutch size ranged from 45 – 346 oocytes for females ranging from 42 – 69 mm. Mature oocytes ranged from 0.62 – 1.81 mm in diameter. We conducted snorkeling surveys from February through April to observe spawning activities. Spawning peaked in April and occurs in runs 10 – 25 cm in depth. Males held loose territories roughly 0.5 m². Female darters selected small to medium sized cobble substrate with crevices sheltered from current for spawning activities. Spawning occurred as both fish wedged themselves into the crevice. *E. whipplei* is broadly similar to many members of its subgenus in most characteristics of its life history outside of its spawning behavior. Peak spawning occurs primarily before and during strong spring rains. Increased siltation from run-off from natural gas related construction activities at this time has the potential to result in embedded spawning substrate, impaired spawning success and/or low survival and recruitment of larvae.

Keywords: Life History; Darter; Spawning Behavior

Drainage: Arkansas

Student Award: Yes

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Contributed Oral

GEOMETRIC MORPHOMETRIC ANALYSIS OF *HYBOPSIS* (CYPRINIDAE)

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Hybopsis is a genus of cyprinids currently including six valid species. Clemmer (1971) suggested that the eastern populations of *H. winchelli* (which have been known as *H. cf. winchelli*), are different from those to the west. The western *H. winchelli* is found in the Mobile River and eastern tributaries of the lower Mississippi River, while the eastern *H. cf. winchelli* is found from the Perdido River east to the Ochlockonee River. These two species can be distinguished by several morphological characteristics. Other studies have supported the hypothesis that *H. cf. winchelli* is a distinct lineage sister to *H. winchelli*. Here, we use geometric morphometrics to analyze the shape differences between all seven *Hybopsis* species. A principle components analysis shows that *H. winchelli* and *H. cf. winchelli* differentiate in shape, which is unusual because most of the remaining species of *Hybopsis* showed broad overlap with one another and with *H. winchelli* and *H. cf. winchelli*.

Keywords: chub; geometric morphometrics; body shape; Procrustes; relative warps analysis
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Contributed Oral

PLANNING, PITFALLS, AND THE ADAPTIVE PROCESS IN STREAM RESTORATION ON EGLIN AFB.

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Significant effort and expense have been invested by Eglin AFB, the US Fish and Wildlife Service, Florida FWC, and other partners in stream habitat restoration for the Okaloosa darter on Eglin AFB. Nearly all of the erosion entering Okaloosa darter watersheds has been controlled, multiple impoundments have been removed, road crossings have been eliminated or replaced, and miles of stream have been constructed. By effectively eliminating threats, improving habitat, and restoring historic range, these efforts were a major factor in the recent reclassification of the Okaloosa darter from endangered to threatened. Successes, mis-steps, and errors made during planning, design and construction have led to the adaptation of standard restoration techniques to suit coastal plain geology and local stream dynamics. Nearly all projects have been colonized by Okaloosa darters, however Okaloosa darter density, fish assemblage structure, and habitat complexity vary among projects. We will discuss the good and the not-so-good in stream restoration projects by providing examples involving partnerships, fish and macrophyte colonization, geomorphic changes, and landuse considerations. Comparisons among example projects will provide insight into the adaptive process in future stream restoration work on Eglin AFB and the coastal plain.

Keywords: stream restoration, coastal plain, darter
Drainage: Choctawhatchee Bay drainage
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Contributed Oral

USING GIS TO PREDICT POPULATION CONNECTIVITY IN SOUTHEASTERN USA RIVERS BASED ON CONTINENTAL SHELF WIDTH.

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The phylogeography of coastal rivers is an important topic that so far largely remains under exploited in terms of its full research potential. Salt water acts as a strong barrier to obligate freshwater species. Salt water barriers are highly dynamic in that they are controlled by sea level changes and coastal geomorphology. As sea levels fall, barriers are removed as formerly isolated rivers may coalesce together and allow dispersal. Therefore, when sea level is lowered, there is greater potential for dispersal to occur. As sea level rises again, barriers reform, isolating the fauna of each now separate river basin. Changes in sea levels occur in cycles, and at least throughout Pleistocene have occurred every 100,000-150,000 years and are thought to be strongly influenced by Milankovitch Cycles. Here I use GIS to map continental shelf width and low sea level drainage patterns to establish some hypotheses that can be tested by phylogeographic data. Broad continental shelves should allow greater opportunities for populations to mix than narrow continental shelves, as there is more opportunity for rivers to coalesce and for fishes to move between coastal floodplains. From this we can predict that fish populations present in coastal rivers that are separated by similar continental shelf widths should have similar genetic divergences, and that those divergences should be greater in narrow shelves and lower in broader widths. By using GIS to quantify potential limitations to gene flow, specific regions and species can be targeted to allow these hypotheses to be broadly tested.

Keywords: phylogeography; GIS; sea level change; connectivity; prediction
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Contributed Oral

THE STATUS OF THE BLACKBANDED SUNFISH AND OTHER SELECT SPECIES IN THE
STATE OF GEORGIA

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The primary purpose of the current study is to examine the status of *Enneacanthus chaetodon*, the blackbanded sunfish, within its known distribution range in the State of Georgia. In addition, this study is also examining the occurrence and status of five other species (*Elassoma gilberti*, Gulf Coast pygmy sunfish; *Fundulus cingulatus*, Banded topminnow; *Fundulus lineolatus*, Lined topminnow; *Fundulus escambiae*, Russetfin topminnow; *Fundulus rubrifrons*, Redface Topminnow) within the habitats sample for blackbanded sunfish. Another current project involving the impact of bridge sites and data from the VSU ichthyology collection is also being used to develop a data base on the distribution of the above mentioned species in the Elassomatidae and Fundulidae. To better understand the ecology of the above mentioned species, a broader analysis of fish assemblages as they relate to vegetated aquatic habitats is also being conducted. Completion of this latter point will permit the assessment of habitats that most closely correlate with the presence of the above mentioned species. Alien species are also being identified and recorded. The data sets developed on all the above mentioned species will permit the Georgia Department of Natural Resources to better assess the distributions and conservation status of the various species.

Keywords: Blackbanded; Sunfish; Fundulidae; Elassomatidae; Conservation
Drainage: Aucilla River; Suwanee and St Mary River Basins; Okefenokee Swamp
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Contributed Poster

RESPONSE OF A FISH COMMUNITY TO RIPARIAN AND STREAM HABITAT RESTORATION IN THE MIDDLE FORK SALINE RIVER, ARKANSAS

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Assessments of aquatic ecosystems are performed to identify the stress and impact of environmental disturbances on the biological community. Sedimentation and the subsequent changes in structural morphology of aquatic ecosystems have been shown to adversely affect macroinvertebrate and fish populations, especially the diversity and abundance of sensitive species. There is a need to expand biological monitoring of fish communities, especially before and after stream restoration projects. A recent survey of river restorations across the U.S. indicated that less than 10% had documentation of assessment and evaluation (Bernhardt et al. 2005, Shields et al. 2006). The Middle Fork Saline River in Garland County, Arkansas has recently been stabilized using cross-vane and J-hook vane structures to decrease sedimentation of the stream bed and erosion of the stream banks. To understand how the fish community structure responded to the restoration, pre-restoration data from the Fall of 2007 and 2008 were compared to fish community data collected in Fall 2011. Three sites within the restored section were sampled quantitatively using a three-pass depletion method. One site from the Alum Fork Saline River, a stream within the Forest Service boundaries, was sampled for a control. Changes in the fish community will be discussed. Continued monitoring of the Middle Fork Saline River will be conducted for long-term data on the effects of physical habitat alteration in the Middle Fork of the Saline River fish community.

Keywords: Middle Fork Saline River; Restoration; Community Response

Drainage: Saline River

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Contributed Poster

WATER QUALITY AS A DETERMINANT OF LARGESCALE STONEROLLER (*CAMPOSTOMA OLIGOLEPIS*) DISTRIBUTION AND ABUNDANCE

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We investigated the effect of water quality on the abundance of *Campostoma oligolepis* (largescale stoneroller) to determine if these environmental characteristics could be used to predict the species distribution pattern. Largescale stoneroller abundance was estimated using standardized electroshocking methods from 32 sites in the Piedmont ecoregion in Cobb and Bartow County, Georgia. Water quality data for the 32 sites was obtained from the local water authorities. Measured variables included temperature, pH, dissolved oxygen, biological and chemical oxygen demand, conductivity, turbidity, nitrate/nitrite, NKTN, total suspended solids, total phosphorous, and total chlorides. Preliminary data analysis indicates weak relationships between two of the water quality variables and the density of *C. oligolepis*. A weak negative correlation between NKTN levels and stoneroller abundance was observed with a correlation coefficient of -0.28. A weak positive correlation between pH and stoneroller abundance was also indicated with a correlation coefficient of 0.39. Additional analysis using multivariate techniques will be used to further investigate the relationship between *C. oligolepis* distribution and variation in water quality.

Keywords: *Campostoma oligolepis*, Water Quality, Urbanization, Population Distribution, Population Abundance

Drainage: Etowah

Student Award: Yes

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Contributed Poster

UP ON "CRYPISIS CREEK": *NOTROPIS LUTIPINNIS* SENDS ME (AN ICHTHYOLOGIST'S DREAM)

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It has long been noted that morphological variation in fin coloration (red, yellow, or white) exists among populations of *Notropis lutipinnis* (Yellowfin Shiner). Fin color is variable within and among some populations, and no studies to date have been able to characterize distinct populations of *N. lutipinnis* based solely on fin coloration. Recent studies have delimited the range of *N. lutipinnis* to include only populations occurring in the Savannah River drainage westward to the upper portions of the Chattahoochee River system of Georgia. Using geometric morphometrics and mtDNA sequence data, we assessed morphological and genetic variation throughout this range. Populations from three river systems (Savannah River, Oconee River, and Ocmulgee River) are highly distinct in morphospace. Additionally, mtDNA sequence data reveal multiple divergent lineages which cross current river system boundaries. Therefore, it is unclear whether the mtDNA lineages and the morphological data identify distinct, cryptic species, or describe a highly variable or polymorphic species. Inclusion of nuclear data and broader taxon sampling for DNA analyses may help to determine which best describes morphological and genetic variation among populations of *Notropis lutipinnis*.

Keywords: population genetics; geometric morphometrics; *Notropis lutipinnis*

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Contributed Poster

CONSIDERATION FOR DESIGNING SPECIES-SPECIFIC MONITORING PROGRAMS FOR RARE AND IMPERILED FISHES

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Effective conservation of imperiled southeastern fish fauna requires the implementation of monitoring programs that are species-specific and scientifically-tested. Monitoring programs were recently designed for two imperiled species, the tuxedo darter *Etheostoma lemniscatum* and the spotfin chub *Erimonax monachus*. Due to the life history differences between a darter and a minnow, we designed two separate monitoring programs for each species. We identified four criteria important to designing a program: capture method, sampling design, habitat requirements, and statistical power. For small populations, a capture method should minimize harm and effectively detect the fish. Furthermore, various sampling designs must be considered and adapted to account for fishes with low population sizes, possible clustered distributions, and rarity within a stream. Identifying suitable habitat will aid in monitoring site selection and increase overall sampling efficiency. Lastly, the final product must provide relevant data that can adequately detect change (i.e., either increasing or decreasing trends) over an acceptable period of time. Our consideration of the criteria resulted in two distinct monitoring programs for the tuxedo darter and the spotfin chub. Although underwater observation was an appropriate capture method for each species, observation protocols differed among species. An adaptive cluster sampling design provided population counts with higher relative efficiencies for spotfin chubs than tuxedo darters, in which a simple random sampling design was recommended. Based upon an annual sampling schedule, at least five and ten years of monitoring data for the spotfin chub and tuxedo darter, respectively, are needed to detect population trends. The greater implication is that, in most cases, a “one size fits all” approach to monitoring is not appropriate, and each species should be considered on an individual basis to achieve the most powerful data from a monitoring program.

Keywords: *Etheostoma lemniscatum*, *Erimonax monachus*, monitoring, sampling design

Drainage: Big South Fork of the Cumberland River, Emory River

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Contributed Poster

INLAND AND COASTAL FISHES OF LOUISIANA: A NEW BOOK PROJECT

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Freshwater Fishes of Louisiana, published by Neil H. Douglas in 1974, treated 170 species, including 21 marine invaders. Much has changed about knowledge of inland fishes in the state since this time, and an updated reference on Louisiana's inland and coastal fishes is long overdue. A current list of fishes from inland and coastal waters of Louisiana, compiled from data in fish collections in the Tulane Museum of Natural History and the University of Louisiana at Monroe Museum of Natural History, includes at least 238 species (155 primarily freshwater, 46 primarily marine, and 35 diadromous). The list has grown through discovery of new species, new distribution records of both native and exotic species, and addition of coastal marine species. The landscape and aquatic habitats of Louisiana have also changed considerably since 1974, and this has no doubt affected fish distribution and abundance patterns. We plan to produce both a newly printed book and a web site that can be continually updated. Research has begun with assembly of a comprehensive data cache of all Louisiana fish collection records. All verifiable records in the dataset will then be checked for taxonomic accuracy and georeferenced. The georeferenced occurrence records in the updated cache will be used to produce updated distribution maps and niche models for all species. The verified data cache will then be used to identify areas in Louisiana in need of additional field surveys. During the field surveys, high-resolution photographs will be taken of each species and additional information about habitat preferences will be documented. The niche models and analyses of abundance trends will be used to assess the conservation status of species presently on the Louisiana Natural Heritage Program's rare and protected fishes list, and for identifying other species in need of protection.

Keywords: distribution; diversity; identification; taxonomy

Drainage: Red River; Mississippi River; Gulf of Mexico

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Contributed Poster

RECOVERY OF THE FISH COMMUNITY OF A RESTORED SECTION OF UPPER LAUREL CREEK IN ROWAN COUNTY, KENTUCKY

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The fish communities of upper Laurel Creek, a headwater stream in the Little Sandy drainage, Rowan County, Kentucky, were collected in spring and summer, 2008-2011, to assess effects of stream restoration. In 2004, the Rowan County Road Department, Kentucky, constructed a road through the valley of Laurel Creek, severely impacting 716 meters of this headwater stream. Stream restoration, with the goals of restoring the contours and vegetation of the riparian area, occurred in fall 2008. The restoration itself has potential to damage fish communities, as it involves considerable earthmoving. Fishes were collected, by seining and electrofishing, in a 100 m reach at each of seven sites (two above restoration, three within the restoration, and two below the restoration), using Kentucky Division of Water standard bioassessment protocols. Fish community health of each sample was assessed by examining fish biomass and abundance, species richness, and Kentucky Index of Biotic Integrity (KIBI) scores. In the year following restoration, sample sites in and below the restored area declined in nearly all of these measures, with most sites scoring as "Fair" by the KIBI. In contrast, sites above the restoration did not decline, scoring "Good" to "Excellent." The community decline was characterized by shifts in relative abundance (fewer individuals of intolerant species, such as *Clinostomus funduloides* and *Cottus bairdii*) and decreased total abundance of fishes, rather than loss of species. During the second and third years following restoration, scores of sites in and below the restored area returned to those of pre-restoration levels, scoring as "Good" to "Excellent" by the KIBI. Habitat scores showed a similar pattern of improvement. Our data suggest restoration appeared to have a short-term negative effect on the fish fauna, perhaps intensified by a severe drought, but had little or no long-term effect.

Keywords: stream restoration; IBI
Drainage: Little Sandy R./Ohio R.
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Contributed Poster

EFFECT OF SMALL DAMS ON NORTH CAROLINA ATLANTIC SLOPE FISH ASSEMBLAGES

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Dams restrict organism movements, impound streams, reduce downstream sediment movement, and alter other stream physicochemical characteristics. Low-head dams (<7 m height) are ubiquitous in the Albemarle-Pamlico (APB) Basin in North Carolina and across the Atlantic Slope. Although these structures may affect biological communities and ecological function across broad geographic scales few studies have quantified their effects on stream fish communities. In 2010 and 2011 we sampled fish at 25 dams (9 breached, 7 relict and 9 intact) in the APB. Study reaches were located 1) upstream of the impoundment, 2) immediately downstream of the dam (mill reach) and 3) approximately 500-1000 m downstream from the dam (n = 75 reaches). We sampled 12 replicate meso-habitats per reach using a backpack electrofisher and seine. We encountered a diverse fish community and 83 species in study streams. Analysis of preliminary 2010 data with mixed general linear models revealed that fish CPUE, Shannon's H, fish abundance, and taxa richness were significantly higher in the mill reach of intact dams when compared to up-and-downstream reaches. However, we found no between-reach differences at breached or relict dam sites. Models also revealed significantly higher CPUE's for Centrarchidae, Catostomidae, Percidae and Anguillidae at intact dam mill reaches compared to up-or-downstream reaches. Small dams appear to be impeding movement of migratory species but may also improve habitats for lithophilic taxa. Additionally, impoundments appear to be important sources of introduced centrarchids and other exotic fishes. These data suggest that small dams have strong, sometimes counter-intuitive, effects on stream fish assemblages. Ongoing analyses will attempt to ascertain the impacts of landuse, habitat parameters (depth, flow, substrate, water chemistry and temperature) on stream fish assemblage and guild structure.

Keywords: low-head dam; Atlantic Slope streams; stream fish

Drainage: Tar, Neuse, Roanoke

Student Award: Yes

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Contributed Poster

HYBRIDIZATION AMONG THREE SPECIES OF BLACK BASS (*MICROPTERUS*) WITHIN THE
MIDDLE CHATTAHOOCHEE RIVER, COLUMBUS GEORGIA

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The introduction of spotted bass (*Micropterus punctulatus*) into the range of the endemic shoal bass (*M. cataractae*) in the Apalachicola drainage in Alabama, Georgia, and Florida has resulted in hybridization between these species. However, research is limited within the Chattahoochee River and does not include hybridization with native largemouth bass (*M. salmoides*). The purpose of the present study is to assess the extent and apparent direction of hybridization within and among populations of *M. cataractae*, *M. punctulatus*, and *M. salmoides*. By using a combination of morphometric and microsatellite analyses, the following questions will be addressed: (i) What is the frequency of hybrids formed between shoal and spotted bass in nature? (ii) Is there evidence of asymmetrical hybridization? (iii) Does morphology variation have a genetic base?

Keywords: Hybridization; Black Bass; Chattahoochee River; Morphometrics; Microsatellites

Drainage: Apalachicola

Student Award: Yes

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Contributed Poster

AN INVESTIGATION OF FISH COMMUNITY AND WATER QUALITY COMPOSITIONS IN AN ISOLATED SIDE CHANNEL OF THE UPPER MISSISSIPPI RIVER

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Connectivity between side channels and the main river channel is critical for sustaining ecological processes and functions for both aquatic and terrestrial communities. Thus, restoring Mississippi River side channels to maintain the ecological integrity of this system has been a high priority for Mississippi River scientists. In 2002 natural resource agencies identified Buffalo Chute as an ecologically important side channel in the Middle Mississippi River worthy of habitat rehabilitation. This chute is one of several island complexes that become isolated from the main channel during low river stages resulting in stratification and anoxic conditions. The primary purpose of the Buffalo Chute Restoration Project is to increase connectivity of the side channel to the main river channel through modification of existing river training structures and dredging. This report summarizes two years of pre-construction data on the fish community and water quality during summer and winter sampling periods. Over two years, 46 sites (45 random sites and 1 fixed site) were sampled in the chute to document fish assemblages using day electrofishing, seining, and trawling. In both seasons, the fish community was dominated by Cyprinidae. In the random sites across both years, mean fish species richness, diversity, and evenness were greater during summer than winter. At the fixed site, species diversity and evenness were greater during winter than summer. Water quality measurements were summarized for the two year study. Stratification (thermal and chemical) was observed in both years during late summer and early fall months as well as anoxic conditions in the lower portions of the chute.

Keywords: Restoration, Middle Mississippi River, fish community, side channels, water quality
Drainage: Mississippi River
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Contributed Poster

THE MIDDLE MISSISSIPPI RIVER SIDE CHANNEL VISION – MOVING FROM CONCEPT TO ACTION

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Side channels on the Middle Mississippi River (MMR) serve as one of the main sources of off-channel wintering, spawning, and rearing habitat for riverine fishes. Due to sedimentation and flow alteration, side channels on the MMR have experienced significant declines in habitat diversity. Recognizing the critical importance of side channels to the ecological health of the MMR, the Corps of Engineers, in partnership with state and federal natural resource agencies, developed the Middle Mississippi River Side Channel Vision. The resulting document outlined the opportunities, goals, and objectives, for MMR side channel restoration. Habitat needs and the necessary actions to achieve those needs were also identified, as was a standard monitoring protocol. The side channel planning team visited and evaluated each existing side channel. Based on those visits each of the 32 areas was given a restoration priority. These rankings were based upon a number of factors including present conditions, potential for restoration, cost, adjacent land ownership, and the availability of similar habitats near the project area. The vision document has served as a cornerstone for subsequent planning efforts, including use by the federal and state agencies to focus restoration efforts and dollars, and non-governmental agencies to help guide land acquisition priorities. Since inception, a number of side-channel projects have been completed and many more are now in the planning phase.

Keywords: Partnerships, vision document, Middle Mississippi River, side channels, restoration
Drainage: Upper Mississippi River
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SHALLOW BATHYMETRIC MAPPING OF BUFFALO CHUTE: EXAMINING CHANGE OVER TIME

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Buffalo Island Chute is located along Middle Mississippi River (MMR), mile 24.5-26.3R. The river's morphology has been changed in part because of channelization and maintenance of the 9-foot navigation channel. In 1796, 55 side channels were recorded in the MMR but fewer than 30 exist today. The goal of this project is to physically alter structures in the chute to improve water quality, diversify habitat, and improve fish community structure. Fish, water quality, and elevation data are being collected to quantify the changes before and after construction. Natural resource agencies identified this chute as an ecologically important side channel in the MMR in 2000, deeming it worthy of habitat rehabilitation. This chute is one of several island complexes that become isolated from the main channel during low river stages. The primary purpose of this restoration project is to increase connectivity of the side channel to the main river channel. In addition to the pre-construction fish assemblage (summer and winter) and water quality monitoring program, we recorded bed elevations through several methods. Water depths were recorded using boat mounted GPS depth sounders. Exposed sandbars were mapped with GPS units and laser levels. All measurements were adjusted to river stage. We collected 5,322 data points in November 2007 and 3,055 data points in December 2008 across the 116 surface acres of the side channel. The elevation waypoints were interpolated into a surface or digital elevation model (DEM) with ArcMap's Spatial Analyst extension. This work allowed us to compare the morphology of the side channel at two different time periods. Using Spatial Analyst again, we subtracted the 2007 DEM from the 2008 DEM to see where sediment had been deposited and eroded. The end result was a raster data set indicating areas of elevation change, which confirmed field observations.

Keywords: Restoration, mapping, Buffalo Chute, Middle Mississippi River, digital elevation models

Drainage: Mississippi River
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DEVELOPMENT OF SPECIES-HABITAT MODELS TO INFORM CONSERVATION PLANNING
FOR FRESHWATER SPECIES COVERED BY THE CUMBERLAND HABITAT CONSERVATION
PLAN

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The Cumberland Plateau maintains a rich cultural and natural history. Human population growth and resource use have placed increased pressure on this unique area. The Cumberland Habitat Conservation Plan (CHCP) is an ongoing effort to balance human needs while protecting rare species through a partnership of government, academic, business, and non-profit stakeholders. Species covered by the CHCP were selected from a list of potential species based on specific criteria developed by the CHCP Science Advisory Committee. We have chosen two covered species for the current study: *Cambarus obeyensis*, an endemic of the East Fork Obey River; and *Cambarus pristinus*, a near-endemic of Caney Fork and the Cumberland Plateau. Both species are considered endangered by the Tennessee Wildlife Resources Agency and recently have been petitioned for federal protection. Little is known about the basic habitat requirements of these species. Such information will be vital in establishing the conservation plans and best management practices established by the CHCP. A survey of 42 sites in the Upper Caney Fork and Obey River watersheds was conducted May through August 2011 to determine presence or absence of the target species. Habitat characteristics for each site were collected at local and watershed scales. Logistic regression models were used to determine if any habitat attributes were useful in predicting the presence of the target species at a particular scale. The CHCP will incorporate these findings to allow informed decisions regarding threats impacting these species and conservation measures needed to protect them.

Keywords: conservation; partnerships; aquatic resources; crayfish

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Contributed Poster

GENETIC VARIATION IN NATIVE AND INTRODUCED POPULATIONS OF MOSQUITOFISH
(*GAMBUSIA AFFINIS* AND *GAMBUSIA HOLBROOKI*)

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Early in the 20th century, mosquitofish were introduced around the world in an effort to control mosquito populations. Recently, researchers have begun using DNA sequence data to look at variation within introduced populations and compare it with genetic variation in native populations. Some of the earliest introductions of mosquitofish outside of the US were to Asia, yet no genetic data is available for these populations. I present preliminary results on (1) genetic variation throughout the native range of both *Gambusia holbrooki* and *Gambusia affinis* and (2) genetic variation from several populations of *Gambusia affinis* throughout Asia. The introduced populations exhibit decreased variation compared to the native populations, but there is some population structure that suggests multiple introductions into China. Continuing work on this system aims to better describe the genetic structure of populations throughout the native range and trace the Asian introductions back to their source in the U.S. using both DNA sequence and microsatellite data.

Keywords: invasive, cyt b, network, southeastern US, Asia

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ASSESSMENT OF FRESHWATER FISH ASSEMBLAGES AND THEIR HABITATS IN THE
NATIONAL PARK SERVICE SYSTEM OF THE SOUTHEASTERN UNITED STATES

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The southeast region of the United States contains the highest diversity of freshwater fish species in the country: approximately 662 species. Existing protected areas like units of the National Park Service (NPS) should reflect this biodiversity, but there has been no broad-scale assessment. We compiled several datasets identifying native freshwater fish species distributions in and surrounding NPS units and threats to those resources. Focusing on the 26 NPS units containing only freshwater fish species, we documented 286 species within NPS boundaries. The largest NPS units tended to have the most fish species and aquatic habitat, but also the greatest amount of alteration. Increasing rates of urbanization, declines in percent agriculture land cover, and increased density of road-stream crossings in surrounding watersheds were good predictors of non-indigenous species presence within NPS unit boundaries. These results help document the role of NPS units in conserving freshwater fish diversity and, in this region, suggest that measures aimed at controlling urbanization in the watershed could affect the diversity of freshwater fish communities in these units.

Keywords: land use, land cover, non-indigenous species, native species, imperiled species

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ADDRESSING CHALLENGES IN SOUTHERN COASTAL PLAIN STREAMS (A THINK TANK)

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Fish community assessment in wadeable streams of the Southern Coastal Plain (SCP) ecoregion has proven to be a challenge for Georgia DNR's Wildlife Resources Division. Therefore, their Stream Survey Team (SST) convened a small group of scientists to a "Think Tank" discussion designed to create a framework for addressing this challenge. Streams in the SCP are characterized by intermittent flow, low pH, low dissolved oxygen, low productivity, and high temperatures, producing a harsh environment for fishes. Wadeable streams in the SCP have also undergone a variety of anthropogenic alterations and have been poorly sampled compared to other parts of the state, making it difficult to establish least impacted conditions. The group identified major drivers affecting stream condition, discussed SST's current Index of Biotic Integrity metrics and their applicability within the SCP, and explored alternative sampling methodologies. Information compiled during the Think Tank will be used to drive SST's on-going research and assessment of fish assemblages in the SCP.

Keywords: Fish IBI, coastal plain, fish assemblages, least impacted condition
Drainage: Savannah, Ogeechee, Altamaha, St Marys, Suwannee, and Satilla
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Contributed Poster

CONTAMINANT BIOACCUMULATION AND TROPHIC CHARACTERIZATION OF TOP-LEVEL PREDATORY FISHES

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Both regulatory and ecological considerations warrant evaluation of contaminant bioaccumulation in top-level predatory fishes. However, variation within and among syntopic top predators is often not well understood. We are comparing trophic position and contaminant bioaccumulation in bowfin, channel catfish, largemouth bass, and longnose gar. Fish were stratified across the broadest size ranges available from two sites on Beaver Dam Creek, a Savannah River tributary located on the Savannah River Site, SC. This stream has a long history of exposure to coal combustion wastes from a coal fired power plant in its headwaters. Comparison of these predators to two herbivorous invertebrates, the Asiatic clam and a heptageniid mayfly, allowed comparison of elements entering the food web to those bioaccumulating in the top-predatory fishes. Stable isotope (N and C) analyses were employed to assess the trophic organization. Trace element analyses assessed bioaccumulation of 16 metals and metalloids. Trophic position varied within species, but on average largemouth bass and longnose gars held a trophic position above channel catfish. Some elements such as Hg and Cs appeared to biomagnify in the predatory fish muscle with concentrations increasing with trophic level. Other elements such V, Cd, Ba, Ni, and Pb accumulated in the basal herbivore invertebrates, but were nearly absent from large predatory fish muscle. Based on the invertebrate analyses, several elements were entering the food web, but not being transferred to large predator muscle tissue. However further analysis found these same elements accumulating in the liver that had effectively sequestered them from accumulation in the muscle. This reduces human health risk, but given the size of the livers and the elevated concentrations, may represent an ecological risk and requires further investigation. Additionally differences in bioaccumulation were observed between and within fish species. Size, trophic position, and at times sex influenced patterns of bioaccumulation.

Keywords: Bioaccumulation; Coal Combustion Waste; Trophic Level; Trace Elements; Predacious Fish

Drainage: Middle Savannah River

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A PRELIMINARY INVESTIGATION OF THE MORPHOLOGICAL DIVERSITY OF GENITAL
PAPILLAE IN *ETHEOSTOMA* AND ITS ASSOCIATION WITH SPAWNING BEHAVIOR

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Females of species of *Etheostoma* display a great range of morphological diversity in genital papillae ranging from squat, villi-rich structures to elongate tubes. Although *Etheostoma* is a well-studied group of fishes, this variation in papillae has been largely unexamined ecologically and phylogenetically. Broad pattern in the variation of papillae morphology is likely associated with their spawning behaviors, categorized as burying, attaching, clumping, and clustering. Using digital photography, variation in the papilla length relative to standard length of 52 species of *Etheostoma* representing these behavioral groups is being studied. Mean relative papillae lengths for species of buriers (n=15), attachers (n=19), clumpers (n=3), and clusterers (n=15) ranged from 0.026-0.076, 0.015-0.109, 0.029-0.075, and 0.012-0.046, respectively. An ANOVA and Tukey's multiple comparisons test of means identified clusterers as significantly different from buriers (p-value<0.01) and attachers (p-value<0.01) in papilla length relative to standard length. The wide range of papilla length found in attachers may be associated with variation within these broad categories of behaviors. For instance, attachers that deposit eggs on algae (0.067±0.03) show differences in mean relative papilla length from attachers that deposit on rocks (0.039±0.01) and macrophytes (0.037±0.01), but no significant difference. These results provide direction in the ecomorphological investigation of spawning behavior showing that egg-clustering darters have shorter papillae than darters exhibiting other behaviors. However, length is a simple metric intended only to investigate elongation of the papillae and falls short of fully describing variation in papilla shape. More descriptive measures of shape are being pursued to further describe the variation of these structures across taxa in order to further examine how genital papillae are adapted to the various behaviors and modes of egg deposition.

Keywords: spawning behavior; morphology; *Etheostoma*

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DO LOW ORDER FLOODPLAIN TRIBUTARIES FUNCTION AS FISH NURSERY HABITAT?

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Rivers are comprised of the main channel and contiguous or isolated floodplain habitats (for example contiguous oxbows, seasonally inundated adjacent floodplain, and tributaries). Floodplain habitats have been shown to provide important spawning and nursery habitat. However, little attention has been directed at the function of floodplain tributaries and whether all tributaries provide similar reproductive habitat. From 2007 to 2011 three low order (1-2) tributaries of the Fourche LaFave River, AR, (Caney Creek (CC), Lawson Creek (LC), and West Fork Mill Creek (WFM)) were sampled for richness and abundance of young of year (YOY) fish species (CC 2007, LC 2007 and 2008, and WFM 2007, 2008, and 2011). Each sampling event was comprised of 3-4 seine hauls per stream section (upper, middle, and lower) and 1-2 mini-fyke nets per sections. Sampling was undertaken to monitor post spawn species richness and abundance and compare differences between years, tributaries, and gear type. Moreover, the goal of this research was to provide a preliminary analysis of floodplain tributaries to undertake a comparison of all floodplain habitats. Across all years, tributaries, and gear types approximately 42 YOY species were collected. Young of year fish fauna among tributaries was very diverse containing ecologically important fishes (*Dorosoma petenense* and *D. cepedianum*), recreationally important fishes (*Lepomis macrochirus*, *L. gulosus*, and *Micropterus salmoides*), and species of conservation concern (*Atractosteus spatula*, *Etheostoma fusiforme*, and *Erimyzon sucetta*). West Fork Mill Creek was the only stream to be sampled in all three years. YOY richness and abundance differed over varying hydrological conditions, being highest in 2007 when flooding was most intense. Preliminary analysis has shown that these low order tributaries are important fish nurseries, containing diverse YOY fish assemblages; necessitating further investigation.

Keywords: Young of Year; River Floodplain; Tributaries; Nursery; Spawning

Drainage: Fourche LaFave

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A NEW PHYLOGENY-BASED CLASSIFICATION OF DARTERS

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Since the introduction of phylogenetic systematics, which aims to reconstruct the genealogical relationships of organisms, taxonomists have worked to create classifications of organisms that reflect inferred phylogenetic relationships. Until very recently, the taxonomic groups that comprise the classification of darters were not discovered, or verified, in the context of objective and data driven phylogenetic analyses. We have compiled a multi-locus dataset for nearly all darter species and phylogenetic analyses reveal that 60.8% (151 of 248) of all species are classified in subgenera that are not monophyletic. However, several group names that are synonyms of subgenera were monophyletic, and often nested in other larger clades that correspond to named groups in the traditional classification. The International Code of Zoological Nomenclature (ICZN) allows only one formal group name between the genus and species, limiting the ability to use existing and new group names in constructing a classification that reflects inferred phylogenetic relationships. We used a rank-free approach to classification and present a taxonomy of darters that defines 45 clade names. Most of the clade names are converted names previously applied to subfamily, generic, and subgeneric ranks. There are 16 new clade names and phylogenetic definitions are provided for all names in the phylogeny-based classification. It is important to note that the new group names are nested within traditionally recognized genera and are available as valid group names under the ICZN. We recommend that *Ammocrypta*, *Crystallaria*, *Etheostoma*, *Nothonotus*, and *Percina* continue to be used as the primary clade names with species epithets.

Keywords: darter, taxonomy, phylogeny
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LIFE HISTORY TRAITS OF THE MIRROR SHINER, *NOTROPIS SPECTRUNCULUS*, IN
WESTERN NORTH CAROLINA

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The life history of *Notropis spectrunculus* (Mirror Shiner) was investigated using seven monthly collections at four locations (Hominy Creek, Pigeon River, two on the Tuckasegee River) in the Tennessee River drainage in western North Carolina. Specimens were collected by seining deep eddies below runs and examined to identify age, growth, reproductive patterns, and feeding habits. The largest *Notropis spectrunculus* male collected was 71 mm SL and 2.39 g total weight. The largest female collected was 77 mm SL and 2.96 g total weight. Sexual maturity occurred at approximately one year of age. The oldest specimens collected were in their third year, and both males and females were collected of this age. Spawning occurred in late spring and early summer with 13-331 mature oocytes (mean = 115.53, SD = 75.36) and male breeding coloration present in specimens collected in May, June, and July. Gut contents consisted mainly of insect parts.

Keywords: Life-history; *Notropis*; Shiner; North Carolina
Drainage: Tennessee River
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HAVE YOU SEEN MY DACE? A LOOK AT *RHINCHTHYS ATRATULUS* IN NORTH ALABAMA.

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The riffle daces, *Rhinichthys* (Cypriniformes: Cyprinidae), are small fishes that are restricted to cool, flowing, headwater streams and springs. Members of the genus are trans- North American in their distribution and currently the center of taxonomic and systematic studies. In Alabama, the Blacknose Dace, *Rhinichthys atratulus*, has historically been found in almost all major tributaries of the Tennessee River basin, the Upper and Middle Coosa River tributaries, and three localities in the headwaters of the Black Warrior River basin. Recently, the populations within the Black Warrior were considered extirpated (Boschung and Mayden 2004); however, a survey of Borden Creek in the Bankhead National Forest revealed that these fishes are still present in the Black Warrior River basin. This was the first documented collection of Blacknose Dace in that area in 40 years. This find raises questions about the importance of this population as a significant evolutionary unit due to their disjunct distribution. Using tissue from the specimen collected in Borden Creek, we have looked at the relationships among the populations of Blacknose Dace throughout northern Alabama to determine relationships between the Tennessee, Coosa, and Black Warrior populations using analysis of the mitochondrial gene, cytochrome b (cytb).

Keywords: *Rhinichthys*; cytb; dace; phylogenetics

Drainage: Tennessee River, Coosa River, Black Warrior River

Student Award: Yes

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PHYLOGEOGRAPHIC DIAGNOSIS OF A NEWLY DISCOVERED POPULATION OF MUD
SUNFISH IN ALABAMA

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A population of Mud Sunfish (*Acantharchus pomotis*) was recently discovered in the lower Tombigbee River (Mobile drainage) of Alabama. This population represents a 225 mile range expansion, with the nearest historical collection record occurring in the Ochlockonee River drainage of Florida. This population is thought to represent either a recent introduction or a relictual population isolated within spatially restricted suitable habitat. In order to diagnose the status of this population, we analyzed nuclear microsatellite length polymorphism and nucleotide variation within the mitochondrial cytochrome *b* gene. We collected or obtained genetic material from the Tombigbee population and 10 historical populations, including representatives from Georgia to New Jersey. Native Gulf drainage population samples were not obtained. The cytochrome *b* sequences were used to infer a Maximum Likelihood phylogeny, in an attempt to identify the sister group of the Tombigbee population. In contrast with codistributed palustrine fishes, the Mud Sunfish exhibits very low (<1%) sequence divergence at the cytochrome *b* gene. Phylogenetic analysis of this dataset does not fully resolve the relationships among native or putatively introduced populations. The few observed nucleotide substitutions suggest a relationship with populations from South Carolina. If this result is corroborated with additional data, we will reject the hypothesis that the Tombigbee population is indigenous. Five microsatellite loci were amplified in order to compare allele size distributions and allelic richness between native and putatively introduced populations. Microsatellite variation in the Tombigbee population is generally lower than Atlantic Drainage populations, and allele length distributions do not differ significantly. A more robust comparison will include native population samples from the Gulf Slope of Florida. Ongoing work will include additional population samples as well as sequence data from a more variable portion of the mitochondrial genome.

Keywords: *Acantharchus*; microsatellite; cytochrome *b*; introduced; phylogeography;

Drainage: Tombigbee, Mobile

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Contributed Poster

LIFE HISTORY OF LARGESCALE STONEROLLER (*CAMPOSTOMA OLIGOLEPIS*) IN
STREAMS WITH DIFFERING LEVELS OF CATCHMENT URBANIZATION

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The persistence of tolerant fish species in degraded stream environments reflects their adaptability. This study is a year-long investigation of the effect of watershed urbanization on the life history of *Campostoma oligolepis* (largescale stoneroller). Life history characteristics of two separate populations of *C. oligolepis* are compared by sampling two streams that differ in the level of urbanization in their upstream catchments. Both streams have similarly sized watersheds and are located in the Etowah River drainage basin within the Piedmont ecoregion. Each stream is sampled once a month during the spawning period and once every other month during the remainder of the year. Standard lengths, presence or absence of secondary sex characteristics, total weight and gonadal weight are recorded for all retained specimens. Information obtained from field and lab measurements include: age structure, age at sexual maturity, length of spawning period and growth rates. Difference in land use in the upstream catchments will be determined using GIS software and variation in stream temperatures determined using continuous stream temperature data loggers. Preliminary results indicate an extended spawning season for the population of stonerollers in the heavily impacted stream. Based on GSI comparisons, stonerollers in the urbanized watershed exhibited a larger minimum size at reproductive maturity than did those in the non-urbanized stream.

Keywords: *Campostoma oligolepis*, Urbanization, Life History, Size at maturity, Spawning season

Drainage: Etowah

Student Award: Yes

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BODY SHAPE AND BURST-SWIMMING PERFORMANCE IN THE *F. NOTATUS* COMPLEX: A TALE OF TWO TAILS.

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Natural selection is considered a major driving force in promoting and maintaining phenotypic diversity. Quantification of traits in various environments may elucidate how natural selection can shape phenotypic diversification in fishes. *Fundulus notatus* and *F. olivaceus* fill similar ecological niches but typically occupy different habitats along the river continuum. *Fundulus notatus* is typically found in downstream reaches, characterized by slow water velocities and high densities of large-bodied predators, while *F. olivaceus* primarily occur in headwaters with higher flow velocities and fewer large-bodied predators. Although *F. notatus* and *F. olivaceus* vary in a suite of phenotypic traits (e.g., *F. notatus* is shallower bodied compared to *F. olivaceus*), it is currently unclear if the disparate environments have also driven diversification in swimming performance of the two species. Here, we predicted higher predation pressure and lower water velocity in large-stream habitats have selected for increased burst-swimming acceleration and velocity in *F. notatus* compared to *F. olivaceus* (which inhabit low predator dense and higher water velocity environments). We used high-speed videography to quantify maximum velocity and acceleration of *F. notatus* collected from the Pearl River (Mississippi) and *F. olivaceus* from surrounding small tributaries. We also assessed the relationship between body shape (using geometric morphometrics) and swimming performance of the two species. Larger individuals exhibited faster burst-swimming speeds and swimming performance was variable within and between species. In addition, body shape variation likely contributed to the observed variation in burst-swimming speeds. Our findings highlight how environmental variation can shape and constrain phenotypic traits of fishes.

Keywords: burst-swimming speed; *Fundulus*; high-speed videography; geometric morphometrics; phenotypic variation

Drainage: Pearl River, MS

Student Award: Yes

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Contributed Poster

CONTAMINANT BIOACCUMULATION AND TROPHIC CHARACTERIZATION OF TWO HERBIVOROUS INVERTEBRATES

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Establishing a baseline of the introduction of materials into the food web from primary producers and micro-organisms is a critical component of trophic studies. It also provides valuable insight on the potential movement of contaminants into the food web. We are examining two invertebrate herbivores that differ significantly in both habitat use and likely food sources. *Corbicula fluminea* lives shallowly buried in the substrate and is known to both filter feed particles from water and scrape deposited materials from surface sediments. The heptageniid mayfly *Maccaffertium modestum* is a dorsoventrally flattened mayfly adapted to cling to and scrape biofilm from the surface of submerged objects such as wood debris. *Corbicula* and *Maccaffertium* were collected from two sites on Beaver Dam Creek, a Savannah River tributary, located on the Savannah River Site, South Carolina. This stream has a long history of exposure to coal combustion wastes from a coal fired power plant in its headwaters. Though not far apart, our study sites differed in proximity to contaminant sources and hydrologic regimes. Stable isotope analyses indicated *Corbicula* and *Maccaffertium* to occupy similar trophic positions. However, the $\delta^{13}\text{C}$ of both *Corbicula* and *Maccaffertium* differed between sites indicating a difference in resource use or C content of assimilated resources. *Maccaffertium* was also more enriched with $\delta^{15}\text{N}$ at the downstream site. Preliminary assessment of trophic contributions of seston, biofilm, and surface sediments indicates highly variable and complex relationships. Differences in bioaccumulation of elements were observed between both species and sites. In *Corbicula*, lower concentrations of elements such as Be, Ni, Cu, Zn, As, Se, and Hg were found at the lower site, but differences between sites were not significant in *Maccaffertium*. Higher concentrations of numerous elements accumulated in *Corbicula* than in *Maccaffertium*. However two notable elements Pb and V accumulated substantially higher in *Maccaffertium*.

Keywords: Bioaccumulation; Coal Combustion Waste; Trophic Level; Trace Elements; Aquatic Invertebrates

Drainage: Middle Savannah River

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Contributed Poster

DISTRIBUTION AND CONSERVATION STATUS OF THE CUMBERLAND DARTER,
ETHEOSTOMA SUSANAE

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The Cumberland Darter, a close relative of the Johnny Darter (*Etheostoma nigrum*), is endemic to a limited portion of the upper Cumberland River drainage in Kentucky and Tennessee. It was first identified as a candidate for federal listing under the Endangered Species Act in 1985, pending additional information. A status survey conducted during 2006-2007 in Kentucky resulted in 51 specimens collected from 14 localities in 12 small streams draining into the Cumberland River immediately above Cumberland Falls, McCreary and Whitley counties. These occurrences are isolated from one another by an average distance of 30.5 stream km, apparently fragmented by sections of stream with poor quality habitat. Historic occurrences in the upper Jellico Creek system in Tennessee are currently being investigated. Isolated populations in Poor Fork and Martins Fork were previously identified as *E. susanae* or as hybrids with *E. nigrum*. These populations have been confirmed as *E. nigrum* based on morphological and genetic data. There does not appear to be current or recent gene flow between these populations and *E. susanae*. Declines in *E. susanae* populations during the past 25 years coincide with increased sedimentation and water quality degradation from coal mining, timber harvest, poor agricultural practices, and other forms of development throughout the upper Cumberland River drainage. This has prompted the U.S. Fish & Wildlife Service to officially list *E. susanae* as endangered, effective September 8, 2011. Conservation efforts aimed at recovery are currently underway, including development of captive spawning protocols and evaluation of small-scale reintroduction using mark-recapture methods. Critical habitat designation has been accomplished and publication of a proposed rule is forthcoming.

Keywords: Cumberland Darter; endangered species; conservation

Drainage: Cumberland River

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Contributed Poster

CRYPTIC INTRODUCTIONS OF HOG SUCKERS, *HYPENTELIUM*, IN THE PEE DEE DRAINAGE IN NORTH CAROLINA

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A cryptic introduction is an undocumented introduction of a species to a drainage in which it is not believed to be native. In North Carolina, two species of the morphologically distinctive catostomid genus *Hypentelium* occur — *H. nigricans*, Northern Hog Sucker, widespread in eastern and central USA and having a native distribution on the south Atlantic slope in the Roanoke, Neuse, Tar, Santee, and Savannah river drainages; and *H. roanokense*, Roanoke Hog Sucker, endemic to the Roanoke River drainage, including the Dan River system in NC. Blotchy-sided age-0 and -1 specimens are sometimes easily confused with similar-age *Catostomus commersonii*, White Sucker, or *Moxostoma rupiscartes*, Striped Jumprock. After re-examining vouchered specimens and reviewing agency gray literature, we have concluded that, during the past 50 years, Northern Hog Sucker has been cryptically introduced into probably three areas of the Yadkin River system of the Pee Dee River drainage—Reddies River watershed; mainstem upper Yadkin River between W. K. Scott Reservoir and Donnaha; and the middle Ararat River subsystem. In April 2009, Roanoke Hog Sucker was discovered by DWQ staff in Pauls Creek, a tributary to Stewarts Creek of the upper Ararat subsystem, the first record of the species outside the Roanoke drainage. 101 specimens ranging from 41 to 109 mm TL, represented age 1–3 fish based on length frequency. Further surveys in April and September 2009 documented its occurrence in the middle and upper Stewarts Creek watershed in Surry County northwest of Mount Airy. Future dispersal of both species may be hampered by dams and inhospitable lacustrine environments. The primary avenue of these cryptic introductions is speculated as bait bucket releases by fishermen seeking trout and Smallmouth Bass.

Keywords: Suckers; Cryptic Introductions; Nonindigenous Species

Drainage: Pee Dee

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Contributed Poster

USING GIS TO PREDICT HOW CHANGES IN SEA LEVEL POTENTIALLY INFLUENCE
PHYLOGEOGRAPHIC PATTERNS IN FRESHWATER AND COASTAL MARINE FISHES

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Most research within phylogeography has concentrated on first identifying a biogeographic pattern from their phylogenetic results and then explaining this pattern due to some earth history event. My goal is to shift the focus in the opposite direction. That is, to map relevant aspects of earth history across the landscape and then see how consistent these earth history patterns are relative to the phylogenetic data. If these aspects of earth history are important in determining biogeographic patterns then phylogeographic patterns should be fairly consistent with them. If the patterns are not consistent then it suggests that we need to find alternative explanations for the observed phylogeographic patterns and that the earth history factors are not strong forces with broad impact. Here I present two examples using different aspects of continental shelf width to predict phylogeographic patterns. The first quantifies the relative degree and difficulty of movement of obligate freshwater organisms between drainage basins via low sea level connections. The second aspect of this research is to quantify potential habitat for coastal marine fishes at different sea level heights to contrast potential changes in population size since the last low sea level stand. Using GIS I have developed datasets that allow researchers to visualize and quantify continental shelf width for any region of the world. I provide some examples that demonstrate the utility of this approach.

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Contributed Poster

UTILITY OF AMPLIFIED FRAGMENT LENGTH POLYMORPHISMS IN A PHYLOGEOGRAPHIC
STUDY OF THE REDBAND DARTER, *ETHEOSTOMA LUTEOVINCTUM*

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Previous studies have demonstrated the utility of amplified fragment length polymorphisms (AFLPs) in assessing genetic variation and phylogenetic relationships among closely related species. More recently, studies have also demonstrated that AFLPs provide phylogenetic resolution among more distantly related groups, but their utility in phylogeographic and taxonomy-based studies has not been thoroughly explored. The Redband Darter, *Etheostoma luteovinctum*, is distributed across the headwaters of the Caney Fork River and Stones River (Cumberland R.) and Duck and Elk (Tennessee R) rivers of central TN. Episodes of headwater stream transfers have been invoked for other similarly distributed fish species and mitochondrial DNA suggests gene flow across system divides in *E. luteovinctum*. To explore the utility of AFLPs in phylogeographic studies and test hypotheses of stream capture, AFLPs were generated using previously published methods and primer pairs for multiple individuals and populations from across the range of the species. Analyses of 310 AFLP loci using Parsimony and Nei & Li distances provided phylogenetic resolution among individual streams, river systems and drainages, providing sufficient signal to test and propose biogeographic hypotheses. A comparison of the observed AFLP-based phylogeographic structure relative to patterns in mitochondrial DNA and morphology will be presented. The implications of these findings for taxonomic and phylogeographic studies will be discussed.

Keywords: AFLP, Darter, *luteovinctum*, phylogeographic

Drainage: Tennessee and Cumberland Rivers

Student Award: Yes

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Contributed Poster

TROPHIC AND POPULATION ECOLOGY OF INTRODUCED FLATHEAD CATFISH
PYLODICTIS OLIVARIS IN THE LOWER TAR RIVER, NORTH CAROLINA

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Introduced apex predators can have dramatic effects on community structure and function of invaded ecosystems. Flathead catfish (*Pylodictis olivaris*) are native to the Mississippi, Mobile and western Gulf Drainages. This large, piscivorous species has been widely introduced by agencies and anglers and recently-founded populations occur in several southern Atlantic Slope drainages. We studied *P. olivaris* diet, condition and growth in the lower Tar River near Greenville, NC. Gut contents confirmed that *P. olivaris* are primarily piscivorous, but a diverse range of prey was consumed. Fish accounted for over 60% of all stomach contents by mass, however the invertebrate families Cambaridae and Corbiculidae were also found in *P. olivaris* guts. A substantial amount of the stomach contents analyzed were unidentifiable fish and invertebrate remains. Examination of *P. olivaris* body condition index revealed that larger fish do not exhibit lowered body condition, suggesting that this population has likely not yet over-exploited its resource base and may also still be expanding. We found that larger catfish (>500 mm) were significantly more likely to have consumed centrarchids than were smaller catfish. When we looked at the relationship between stomach fullness and body size, older fish had more full stomachs. Although we observed a linear relationship between age of fish and length, mass and age exhibited an exponential relationship. It seems likely that flathead catfish may be exerting effects on Tar River communities similar to effects reported from other recently-invaded drainages including reduced abundance of mesopredatory centrarchids and ictalurids. Our preliminary data suggest that Tar River flathead catfish populations may be currently growing in size. The distribution of flathead catfish in the Tar Drainage is currently limited by several barriers; naïve reaches support populations of several high conservation concern fishes and mussels. Ongoing work is examining ecosystem-level consequences of this large, apex predator.

Keywords: invasive predator; diet; age; condition
Drainage: Tar River, NC
Student Award: Yes
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Contributed Poster

THE EFFECTS OF HABITAT FRAGMENTATION ON THE YAZOO DARTER (*ETHEOSTOMA RANEYI*)

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The Yazoo Darter, *Etheostoma raneyi* (Percidae, subgenus *Ulocentra*), is a small benthic insectivore endemic to the headwater streams of two river systems in the upper Yazoo River basin in north-central Mississippi. The species lives <3 years, has a female-biased sex ratio, and has relatively low fecundity. Extensive anthropogenic habitat alteration has created ostensible barriers to dispersal in the form of numerous impoundments, road crossings, and channelized stream reaches. However, this headwater fish species possibly existed in semi-isolated populations before European settlement. Related work revealed a relatively high level of population structure within and among watersheds across the range of the species, and excess heterozygosity relative to Hardy-Weinberg expectations indicated that relatively recent population declines may have occurred. Here, our goal was to quantify population declines, estimate effective population sizes (N_e) and determine if detectable levels of migration have occurred both recently and historically among populations using data obtained from microsatellite markers. Using two different approaches, we found evidence for population bottlenecks across the range of the species and small contemporary effective population sizes across all genetically distinct populations using two different approaches. We also detected signals of recent and severe declines in contemporary migration rates as compared with historical rates of migration. Our findings suggest that anthropogenic habitat alteration has resulted in population fragmentation and isolation and a general trend of decline in effective population size to dangerously low levels.

Keywords: barriers; endemic; microsatellite; migration; bottlenecks

Drainage: Little Tallahatchie River (Yazoo River Basin)

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Contributed Poster

DEVELOPING ECO-GEOMORPHOLOGICAL DESIGN AND ASSESSMENT TOOLS FOR THE TALLAPOOSA RIVER IN THE ALABAMA PIEDMONT

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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 would result in improved stream evaluations and designs increasing the effectiveness of restoration projects. Stream regional curves currently do not exist for the Piedmont region of Alabama. Thus we selected stable reference reaches in 18 relatively undisturbed watersheds in the Tallapoosa River drainage in the Piedmont 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 0.26 – 290 km with channel widths from 2 – 35 m. Power function relationships developed using regression analyses for channel dimensions as functions of watershed drainage area will be presented. Instream fish, crayfish, and insect biota, riparian vegetation, and floodplain soil will be characterized for each watershed; taxonomic and trait associations are quantified. This stream design and assessment tool will improve restoration projects by offering reference morphological relationships that describe target stream and floodplain ecological conditions.

Keywords: geomorphology, fish, crayfish, insects, piedmont

Drainage: Tallapoosa River

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Contributed Poster

ICHTHYOFAUNAL DIVERSITY WITHIN THE CHOCCOLOCCO CREEK WATERSHED,
CALHOUN CO., ALABAMA

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Choccolocco Creek, a subwatershed of the Coosa River system in NE Alabama, supports a diverse assemblage of endemic aquatic organisms including many endangered and threatened species. Fish assemblages in the watershed have been documented; however, extensive surveying of all tributaries in the system is incomplete. For this study, sites surveyed included USGS biological monitoring stations along the Choccolocco main stem as well as remote and/or difficult to access sites within the watershed. New sites were selected based on potential habitat for imperiled endemic species such as the Holiday darter, *Etheostoma brevirostrum*, or the Blue shiner, *Cyprinella caerulea*. Creeks specifically surveyed included Choccolocco, Cheaha, Chinch, Coldwater, Cottaquilla, Cathy's, Dry, Egongia, Hillabee, Jones Branch, Salt, Scarbrough, Shoal, and Little Shoal. Sites were surveyed following the USGS protocols for ichthyofaunal sampling. The index of biological integrity, or IBI, was calculated for each site. Based on fish assemblages, calculated IBIs for the various sites ranged from "fair" to "good". Although suitable habitat can be found at other sites on the Choccolocco watershed, Holiday darter populations remain to be found only within the Shoal creek subwatershed. Likewise, suitable habitats for the Blue shiner can be found throughout the watershed, however, populations appear restricted to the middle and upper sections of the main stem of Choccolocco creek. Although many anthropogenic factors affect fish assemblages in the region, impoundments are likely a major contributor affecting fish distribution within this system.

Keywords: Blue Shiner; Choccolocco Creek; Holiday Darter
Drainage: Choccolocco Creek, Coosa River
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Contributed Poster

PRELIMINARY ASSESSMENT OF HYBRIDIZATION OF *MORONE* SPECIES IN THE TOLEDO
BEND RESERVOIR, LOUISIANA

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Widespread introduction of Striped Bass (*Morone saxatilis*) into reservoirs often creates opportunities for hybridization with naturally occurring White (*M. chrysops*) and Yellow (*M. mississippiensis*) Bass. Although recently hybridized Striped X White Bass are typically detectable by morphology alone, back-crossed individuals may not always be reliably diagnosed morphologically. Striped Bass have been stocked extensively into the Toledo Bend reservoir in northwestern Louisiana for many years. Couch et al. (2006) developed a suite of microsatellite markers to detect and diagnose hybridization between Striped and White Bass. We used a subset of these markers in samples from Toledo Bend to look for evidence of hybridization of stocked Striped Bass with native White Bass. We additionally evaluate the utility of these markers to diagnose hybridization of Striped and/or White Bass with Yellow Bass.

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THE EFFECTS OF URBANIZATION ON FOOD SOURCES AND GUT MORPHOLOGY IN
LARGESCALE STONEROLLER (*CAMPOSTOMA OLIGOLEPIS*)

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Urbanization can alter periphyton community structure in lotic systems. Intraspecific differences in the gut quotients of herbivorous freshwater fishes have been related to differences in periphyton assemblages. The purpose of this study was to determine whether there is a relationship between stream urbanization levels and the gut quotients of (*Campostoma oligolepis*). Individuals were collected by backpack electroshocking in May and June of 2011 at two stream sites with differing levels of anthropogenic impact in Paulding County and Cobb County, Georgia. The specimens were dissected and guts were removed and uncoiled. Gut length was measured and the ratio between gut length and standard length of the fish ($Qg = \text{Standard Length} / \text{Gut Length}$) was calculated. Preliminary t-test results followed predictions for May with a significantly larger mean Qg in the more impacted site (0.194 vs 0.171) but there was no significant difference between sites in June. ANOVA indicated significant differences in Qg between sites, and months, indicating stream-specific and seasonal effects on *C. oligolepis* gut lengths. The evident plasticity of gut length could be affected by human impact although seasonality and other factors such as spawning behavior could also affect gut length and explain the temporal variation of Qg. Further field collections and gut content analysis will be highly beneficial to elucidating these relationships, and the success of *C. oligolepis* as a cosmopolitan species.

Keywords: *Campostoma oligolepis*, gut morphology, periphyton, urbanization

Drainage: Etowah

Student Award: Yes

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Contributed Poster

FISHES OF OHIO INVENTORY AND DISTRIBUTION PROJECT

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All authors affiliated with the Ohio State University Museum of Biodiversity Fish Division

The classic book Fishes of Ohio by M.B. Trautman is now 30 years old. Fish distributions can change significantly over that amount of time. The Ohio State University Museum of Biodiversity Fish Division has been given the task of creating new up to date distribution maps for all species of fish found in Ohio with an emphasis on rare and protected species. We are using multiple sources of existing locality data and where needed are generating new locality data for these maps. Species that will be highlighted include but are not limited to; gilt darter *Percina evides*, rosieside dace *Clinostomus funduloides*, spotted darter *Etheostoma maculatum*, tippecanoe darter *Etheostoma tippecanoe*, and bluebreast darter *Etheostoma camurum*. Once we have a complete set of maps the intention is that these will be put into a future publication as a new Fishes of Ohio.

Keywords: Ohio, distribution, Percina, Etheostoma, Clinostomus

Drainage: Upper Ohio and Lake Erie

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Contributed Poster

DISTRIBUTION AND MICROHABITAT ASSOCIATIONS OF THE RARE BARRENS DARTER,
ETHEOSTOMA FORBESI

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Microhabitat studies provide spatially explicit information about fish habitat use. Habitat use may be determined by several factors including but not limited to competition, predation, and environmental variables. Identifying the factors that influence habitat use is fundamental to developing conservation strategies, particularly for rare species. The Barrens Plateau region of middle Tennessee harbors a number of unique and rare aquatic species, including the Barrens darter (*Etheostoma forbesi*). Potential threats to the Barrens darter include anthropogenic pressures such as habitat loss and/or modification, limited availability of spawning habitat, and competition or hybridization with the closely related fringed darter, *Etheostoma crossopterum*. However, the recent study by Bergen (2010) suggests that the spawning habitat preferences of the Barrens darter may act as an isolating mechanism discouraging hybridization between Barrens and fringed darters. During June – October of 2009, we sampled 44, 100-m reaches in 29 streams for Barrens darters. Sampling goals included: 1) documenting the current distribution of the Barrens darter at most known historical collection localities and at additional localities within their potential range on the Barrens Plateau, and, 2) quantifying microhabitat variables to determine if the Barrens and fringed darters exploit different microhabitats outside of the spawning season. We found Barrens darters present at 7 of 42 reaches in 6 of 29 streams. Fringed darters were present at 6 of 42 reaches in 5 of 29 streams. Our current results are consistent with previous surveys that highlight the limited distribution and rarity of the Barrens darter. Results from multiple one-way ANOVAs revealed significant differences in conductivity and total dissolved solids between Barrens and fringed darter sites. Additional research goals include identifying environmental variables associated with Barrens darter presence at larger spatial scales.

Keywords: *Etheostoma forbesi*, *Etheostoma crossopterum*, microhabitat, hybridization

Drainage: Cumberland River

Student Award: Yes

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