



Southeastern Fishes Council Annual Meeting Abstracts November 12 & 13, 2009 Guntersville, Alabama

Abstracts are listed alphabetically by presenter in three different sections: Priority Rivers Symposium, Contributed Oral Presentations, and Posters.

Priority Rivers Symposium

Priority rivers for conservation of imperiled fishes in Arkansas

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Arkansas has one of the most diverse fish faunas in the United States, owing partly to the wide range of physiographic regions found within the state. The diversity in fish fauna ranges from upland species (Ozark and Ouachita uplands) to lowland to riverine species and is divided into five main drainage basins including the Arkansas, Ouachita, St. Francis, Red and White rivers. The priority rivers identified for fish conservation were the Ouachita, St. Francis and White rivers that encompass 29 species identified by the American Fishes Society Endangered Species Committee. There are 32 species considered special concern, threatened or endangered by the Arkansas Game and Fish Commission and 5 endemic species, many of which are located within the priority rivers. Major environmental perturbations facing aquatic systems in Arkansas include agriculture, dams, channelization, invasive species, groundwater contamination, land use alterations. Ongoing threats and efforts to mitigate these impacts will be discussed.

Priority Rivers Symposium

Priority rivers for conservation of imperiled fishes in Georgia

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The 2008 AFS imperiled fishes list includes 62 taxa that are known from Georgia waters, but 7 of these may be extirpated from the state. We identified the number of imperiled fish taxa in each of Georgia's 52 HUC 8 watersheds to prioritize rivers for conservation. The Etowah, Conasauga, and Coosawattee rivers had the highest imperiled fish diversity and collectively include 21 taxa, all of which are extant in at least one of the three systems. The Etowah River system is the richest with 14 imperiled fish taxa (six endemics) and is primarily threatened by urbanization associated with metro Atlanta. The Conasauga River system has 12 imperiled fish taxa (2 endemics) and is primarily threatened by agricultural runoff. The Coosawattee River system has 9 imperiled fish taxa (one endemic), but two of these taxa are only represented by historic records. Because detailed prioritization and threat analyses have already been completed or ongoing for the Etowah and Conasauga systems, we carried out similar analyses for the Coosawattee River system. Our prioritization is focused on protecting important populations of goldline darters, holiday darters, trispot darters, and bridled darters. Primary threats to these species are riparian forest destruction for vacation homes, non-point source pollution from cattle and poultry operations, and fragmentation from existing and proposed reservoirs. Conservation actions include outreach promoting riparian zone protection and reforestation, conservation easements in key areas, and the use of water conservation and existing reservoirs to meet additional water supply needs.

Priority Rivers Symposium

Priority rivers for conserving rare fish species in the state of Louisiana

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The vast majority of the imperiled fishes in the State of Louisiana occur in the Pearl, Red, and Sabine River drainages. In this presentation, we identify these rivers as priority rivers for fish conservation in the state. We review overall fish diversity in these river systems, and examine historic distributions and recent population trends of fishes from these rivers on the state's Rare Animals of Conservation Concern species list. One of the species, the Pearl Darter, *Percina aurora*, has been extirpated from the state, and several others have experienced steep population declines. We used a recently constructed information system, the Louisiana Fish and Wildlife Conservation Network (<http://www.museum.tulane.edu/lfwcn>) to compile this information. We present niche models constructed for each of the species to identify critical habitat. We review current threats to continued survival of the species in each of the river systems. Lastly, we recommend steps that should be taken to improve conditions in these river systems for fishes and other aquatic organisms.

Priority Rivers Symposium

Priority rivers for imperiled southeastern fishes: Tennessee

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With approximately 340 total species, Tennessee has the richest freshwater fish fauna of any of the United States. Tennessee is also home to a complex geologic and hydrographic diversity, as reflected by the number of hydrological units (HUC's) draining the area within its borders. According to the U.S. Geological Survey, there are ten accounting units (6-digit HUCs) and 54 cataloguing units (8-digit HUCs) within Tennessee's boundaries. In the third compilation of imperiled (i.e., endangered, threatened, and vulnerable) plus extinct freshwater and diadromous fishes of North America prepared by the American Fisheries Society's Endangered Species Committee, a total of 78 imperiled species was listed as occurring in Tennessee (Jelks et al., 2008). The three most imperiled rivers (8-digit HUCs) based on the number of imperiled fish species, are the Duck River (exclusive of the Buffalo) (N = 13), Tennessee River and tributaries upstream of Watts Bar Dam (exclusive of the Clinch, French Broad, and Holston basins) (N = 12), and the lower Little Tennessee River (N = 12). Considering native species, the Duck River has a total of 140 extant and two extirpated species (9% of fauna imperiled), the upper Tennessee River and direct tributaries have a total of 99 extant and 12 extirpated species (11% of fauna imperiled), and the lower Little Tennessee River has a total of 95 extant and three extirpated species (12% of fauna imperiled). Overall, approximately 25% of Tennessee's native fauna is imperiled, based on the Jelks, et al (2008) list.

Priority Rivers Symposium

Priority rivers for conserving rare fish in the state of Missouri

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Missouri, with 220 recognized taxa, has a rich fish fauna given its geographic location in North America. This diversity exists, in part, because the Interior Lowlands and Interior Highlands converge in Missouri. Four ecological sections encompassing 45 watersheds are recognized in the state; each section possesses unique fish communities. The Missouri Department of Conservation (MDC) lists 68 fish species of conservation concern, of which 19 are endangered. The American Fisheries Society (AFS) Endangered Species Committee recently published a list of imperiled fishes in North America of which 31 are known from Missouri. We examine trends in Missouri's imperiled fishes based on the AFS publication delimited by the boundaries of southeastern United States rivers per Southeastern Fishes Council (SFC) definitions. The top four rivers containing the highest number of imperiled fishes in Missouri, thus are termed "priority rivers" for conservation, are the Mississippi (15 species), Black (11), Osage (9) and St. Francis (9). The St. Francis River is also a priority river in Arkansas. Threats to these systems and efforts under way to conserve them are presented.

Priority Rivers Symposium

Alabama's Most Imperiled Rivers

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Alabama is home to the greatest freshwater fish diversity of any state, but it also has the largest number of imperiled fishes. These endangered, threatened, and vulnerable taxa are not evenly distributed across the state, with the Tennessee, Coosa, and Black Warrior River drainages home to the highest numbers of at risk fish species. The most imperiled of these (endangered and threatened) are typically found in upland areas above the Fall Line. These taxa are distributed across these three drainages; several represented by narrow endemics. Common threats to all three rivers include habitat destruction and fragmentation from mainstem and tributary dams, channelization, sedimentation from not implementing Best Management Practices, and a lack of historically abundant surface and ground water due to overuse by municipalities, industry, and agriculture. Coal mining and urbanization are additional threats, creating water pollution, impervious surfaces, and stormwater runoff. To prevent continued habitat loss and degradation and to promote or continue recovery efforts, all public and private stakeholders (municipal, state, federal, and non-government agencies and landowners) must work together to alleviate threats within these river drainages in Alabama.

Priority Rivers Symposium

Virginia Priority Rivers for Conservation of Imperiled Fishes

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Over 230 taxa of fishes are distributed across 12 river drainages in Virginia. Four of these Virginia drainages have especially diverse ichthyofaunas of approximately 100 different taxa: James 109, Roanoke 103, Clinch/Powell 103, Holston 97. Of the more than 230 taxa, only 6 are listed by the U.S. Fish and Wildlife Service as imperiled, yet 34 are considered imperiled by Jelks et al. (2008). These 34 taxa are disproportionately restricted to three of these most diverse drainages. The Clinch River drainage has a total of 14 imperiled species, the Holston River drainage has 11, and the Roanoke River drainage has 9. All of these drainages have suffered habitat degradation by impoundments and increased siltation from agriculture, logging, and development. The Clinch is specifically threatened by runoff from coal mines, the Holston has a long history of chemical pollution from industry, and the Roanoke is threatened by increasing urbanization of the Roanoke Valley. Efforts to conserve the fishes of these drainages include regulation of runoff, ongoing surveys, genetic research, and captive propagation.

Priority Rivers Symposium

Priority Rivers for Conservation of South Carolina's Imperiled Fishes

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Sixteen of the 159 fishes found in South Carolina fresh waters are considered to be imperiled by the American Fisheries Society's Endangered Species Committee (Fisheries 2008). Three are considered to be Endangered, one Threatened, and 12 Vulnerable. The Pee Dee River drainage contains 13 of the 16 listed fishes (12% of its total number of fishes), the Santee drainage has 12 (9%), the Edisto drainage has 9 (10%), and the Savannah drainage has 9 (7%). All 16 imperiled species occur on the Coastal Plain, 4 can also be found in the Piedmont, and 2 in the Blue Ridge. Nine occur in variously-sized rivers while the other seven are typically found in streams and swamps. Threats to South Carolina's streams include fragmentation of habitat, channelization, conversion of agricultural and forested land to urban areas, stormwater and wastewater issues, hydrologic modifications, and expansion of introduced piscivores. Conservation efforts include a proactive statewide strategy to protect habitat through watershed planning. Specific projects are also carried out as opportunities arise, including dam removal, channel and riparian restoration, purchase of hardwood wetlands, and FERC relicensing requirements.

Priority Rivers Symposium

Priority rivers for conservation of southeastern imperiled fishes – Mississippi

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Total fish diversity in Mississippi ranks 5th among southeastern states, a pattern similarly illustrated by its mollusk and crayfish fauna. We examined fish diversity within Mississippi based on distribution patterns depicted by comprehensive statewide databases (Ross 2001; MMNS Ichthyology Collection) and their corresponding 8-digit HUC codes. The final species data matrix included 222 taxa and 54 HUCs. We coded species using number of endemics, USFWS listed species, MS listed species, natural heritage program ranks, and SFC (Warren et al. 2000) and AFS conservation ranks (Jelks et al. 2008). Each corresponding matrix was analyzed to evaluate imperilment patterns based on the described categories. Resulting imperilment patterns were loosely concordant with overall species diversity patterns, depending largely on the number of taxa included in the analysis. Consensus among all analyses, based on ranked scores, identified numerous hotspots of biodiversity and imperilment. These zones included reaches of the Pascagoula, Pearl and Tombigbee River systems. The identified areas also correspond well with conservation targets identified by the Mississippi SWG Comprehensive Wildlife Conservation Plan.

Priority Rivers Symposium

Priority Rivers for Conservation of Imperiled Fishes in Kentucky

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Kentucky is characterized by its varied physiography and abundance of natural waters. Twelve major river basins are recognized within the state, which is bordered by the Ohio and Mississippi rivers. Kentucky's native fish fauna includes 237 species, representing approximately 30% of the entire native North American freshwater fish fauna. Of these, 38 (16%) are considered imperiled or extinct by the American Fisheries Society's Endangered Species Committee. The majority of these taxa (numbers in parentheses) occur in the upper Green River (13), South Fork Cumberland River (13), Licking River (6), Rockcastle River (5), and Barren River (5). The South Fork Cumberland River drainage (Big South Fork and Little South Fork) contains the highest proportion of imperiled fishes that are threatened (2), endangered (2), or extinct (1). The upper Green River system, which includes a portion of the karst region of the Highland Rim, supports all three cavefishes that occur in the state. Because of Kentucky's diverse physiographic character, threats to aquatic habitats among and within each of these river basins are equally diverse. These range from obvious factors such as impoundment, channelization, coal mining, and poor silviculture practices to the more widespread impacts from non-point sources of sedimentation, domestic and industrial pollution. Twelve species are imperiled because of their high degree of endemism; anthropogenic threats within their small native ranges compound their degree of imperilment. The South Fork Cumberland and Rockcastle are the only two Priority Rivers that are unimpounded and largely within remote and well forested watersheds. Various ongoing or planned efforts to restore stream habitat, recover species, and protect remaining high quality areas will be discussed.

Priority Rivers Symposium

Priority Rivers for the Conservation of North Carolina's Imperiled Fishes

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Thirty-four of North Carolina's 215 indigenous, described and undescribed, freshwater fish species are considered imperiled by the American Fisheries Society (2008) as either vulnerable (19), threatened (10), or endangered (5). Since 1979 the number of imperiled species has almost doubled with only the Kanawha Minnow, Bigeye Jumprock, and Kanawha Darter being de-listed during this period. Except for the Waccamaw Darter which has a restricted range, the modification and loss of a taxon's habitat was the listing justification for 33 species. The Greater Yadkin-Pee Dee River system has 17% of its indigenous fauna imperiled, the most of any system; only the Watauga and the New rivers systems had none of their fauna imperiled. The Yadkin-Pee Dee (16 species, including the Robust Redhorse), Neuse (9 species, including the Carolina Madtom), and Little Tennessee (7 species, including the Sicklefin Redhorse) rivers systems were selected as the priority rivers for conservation accounting for 25 imperiled species. Major threats to these systems include urbanization that results in poor water quality, hydrologic modifications and habitat fragmentation due to existing dams and the construction of new reservoirs; the establishment, expansion, and ramifications of nonindigenous species; and nonpoint source runoff of sediment and of waste from confined animal feeding operations. Conservation efforts in these systems include intensive surveying and life history-habitat utilization studies of listed species; captive propagation and re-introductions, studies of potential impacts of nonindigenous species; dam removal; participation in the FERC relicensing process; establishment of watershed, county, and regional conservation partnerships; and the acquisition of river corridor easements and new state parks.

Priority Rivers Symposium

Rare fishes of Florida's inland waters: diversity, listing criteria, and watersheds of management concern

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Florida is currently revising its procedures for listing imperiled fishes and proposes three scenarios intended to clarify differences between species listed by the State and those listed under the Endangered Species Act (ESA). The shortnose sturgeon and Okaloosa darter (both endangered) and Gulf sturgeon (threatened) are the only freshwater or diadromous fishes in Florida currently listed under the ESA. The Florida Fish and Wildlife Conservation Commission (FWC) currently lists 3 fish taxa as endangered, 2 as threatened, and 10 species of special concern. The defunct Florida Committee on Rare and Endangered Plants and Animals (FCREPA), an independent advisory body, formerly recognized 2 fish taxa as endangered, 17 threatened, 13 rare, and 7 species of special concern. The American Fisheries Society (AFS) recently considered 1 fish taxon for Florida to be endangered, 7 threatened, and 16 vulnerable. Ten taxa were common to FWC and AFS lists, whereas 16 were common to FCREPA and AFS lists. Discrepancies among lists relate to historical State-specific listing criteria (e.g., inclusion of peripherally distributed taxa, marine species) and those invoked by other organizations. In 1998, FWC published a GIS-based conservation assessment of watersheds based on numbers of fish ranked by FCREPA and the Florida Natural Areas Inventory (FNAI), using a combined scoring approach. The Escambia River system contains the greatest number of imperiled fish species, followed by the upper Apalachicola River and the Choctawhatchee River system, each with notable sub-basins of management concern. Other watersheds with rare fishes, mostly situated in the northern half of the state, include the Ochlockonee, Aucilla, Econfinia, Fenholloway, Suwannee, St. Marys, St. Johns, and a few isolated coastal systems in the southern half of the peninsula.

Priority Rivers Symposium

Priority Rivers for Conservation of Imperiled Fishes – West Virginia.

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Fishes of West Virginia occur within watersheds of the Ohio River drainage or the Atlantic slope (Potomac and James rivers). Currently, none of the 184 fish species in West Virginia are federally listed, although several species are rare or have geographically-restricted distributions within the state boundary. Species inventory and monitoring are routinely conducted by biologists and researchers from state and federal agencies, and universities. Three watersheds with relatively high species diversity or unique fish assemblages include the Elk River (tributary of the Kanawha River), the Little Kanawha River (direct tributary of the Ohio River) and the Greenbrier River (tributary of the New River). Threats to fishes within these watersheds include nonnative species, and several landuse practices that result in water quality degradation or sedimentation, such as environmental impacts associated with the extraction of coal, timber, and natural gas. A current concern is the potential for environmental impacts associated with drilling for natural gas in Marcellus Shale. Rare species and fish communities within these watersheds would benefit from additional research and conservation actions that address nonnative species, water quality, and sedimentation.

Oral Presentation

Occupancy estimation and modeling of the *Etheostoma brevirostrum* species complex within the Etowah River system of Northern Georgia.

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Etheostoma brevirostrum (holiday darter) is a sparsely distributed fish species found within the Coosa River system of Tennessee, Georgia, and Alabama. Within the Etowah River system of northern Georgia, two genetically distinct species of holiday darters are thought to be extant: *Etheostoma* sp. cf. *E. brevirostrum* A [Amicalola system] and *E. sp. cf. E. brevirostrum* B [Etowah system]. Patterns of spatial variation of the two holiday darter species were studied in an attempt to refine their known geographic range and to explain variations in occupancy and detection. Forty-one surveys were completed within the Amicalola Creek system and the upper Etowah River system. *Etheostoma* sp. cf. *E. brevirostrum* A & B were collected at eight sites each, including four new localities for each taxon. Using models that account for incomplete detection, the distributional patterns observed in this study were used to discriminate among competing hypotheses regarding the factors influencing variations in occupancy. Results suggest that small decreases in the amount of forest cover within these headwater systems adversely affect holiday darter populations. Additionally, occupancy models suggest that the Etowah holiday darter occupies a smaller area than the Amicalola holiday darter.

Oral Presentation (student competition)

Phylogeography and population genetics of the Mountain Madtom, *Noturus eleutherus* (Siluriformes: Ictaluridae)

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Subdivision among populations of the Mountain Madtom (*Noturus eleutherus*), a diminutive catfish found in small to large rivers throughout the eastern and central United States, was investigated using phylogenetic and population genetic analyses of the cytochrome b and ND4 genes from 26 (59 individuals) and 7 (20 individuals) localities, respectively. Maximum parsimony, maximum likelihood and Bayesian analyses of the datasets indicated little phylogenetic structure among populations, with many unresolved polytomies and shared haplotypes. Populations from west of the Mississippi River consistently grouped with high branch support in maximum likelihood and Bayesian analyses and did not share haplotypes with populations from east of the Mississippi River. Population genetic analyses revealed significant structure among drainages and highland regions (Eastern and Interior highlands). AMOVA results gave moderate to high among-population fixation indices (Φ_{st} ; 0.47 – 0.66), and among-group fixation indices varied (Φ_{ct} ; 0.15 -0.42) depending on grouping scheme. All populations except Saline River had high haplotype diversity relative to nucleotide diversity. Mismatch analysis indicated a good fit of pairwise distance data to a model of rapid population expansion for the pooled data, Eastern Highlands data and Interior Highlands data. Tests for selective neutrality showed significant departures for the pooled (Tajima's $D = -1.85$; Fu's $F_S = -24.49$) and Eastern Highlands (Tajima's $D = -2.14$, $p = 0.002$; Fu's $F_S = -22.03$) data, but not for Interior Highlands. These results suggest a recent demographic expansion from a small ancestral population. The observed pattern is likely the result of historic changes in topography and river drainages as a result of Pleistocene glaciation and is broadly consistent with other studies of Central Highland fishes and other aquatic organisms reviewed herein.

Oral Presentation (student competition)

A Survey of Fishes of Rock Creek, Kentucky, with Emphasis on the Impact of Stocking Rainbow Trout on Native Fishes

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Rock Creek is a tributary of the Big South Fork Cumberland River that spans twenty-one miles (thirty-three km) and is designated a Wild and Outstanding Natural Resource Water by the Commonwealth of Kentucky. Sections of lower Rock Creek have been severely impacted by past coal mining activities. Reclamation activities in 1999-2000 have improved water quality and recent survey data have shown an increase in abundance and diversity of fish and macroinvertebrates. Rock Creek supports five state listed fish species of greatest conservation need (SGCN) and the federally endangered blackside dace (*Phoxinus cumberlandensis*). Rainbow trout have been stocked annually since the early 1960s, but their impact to smaller native fishes had not been investigated. Field work was conducted in 2008 and 2009 by backpack electrofishing and seining. A total of 44 fish species representing 8 families were collected during 33 sampling events at 29 sites distributed from the KY/TN line to the confluence with Big South Fork. Sawfin shiner (*Notropis sp.cf. spectrunculus*) was not previously reported from below Hemlock Grove indicating a downstream range extension. Blackside dace (*P. cumberlandensis*) was collected in four tributaries including Puncheon Camp Branch where it was not previously reported. Rainbow trout were collected at six sites along with two SGCN, *N. sp.cf. spectrunculus* and *Etheostoma baileyi*. Gut content analysis of rainbow trout included remains of telescope shiner (*N. telescopus*), barcheek darter (*E. obeyense*), and macroinvertebrates, but no SGCN. In light of improved fish species richness and abundance in lower Rock Creek, reclamation practices that mitigate impacts of acid mine seepage should continue, followed by careful monitoring of fish and macroinvertebrate communities.

Oral Presentation (student competition)

If you build it, who will come? Differences in spawning assemblage structure between *Nocomis micropogon* and *Semotilus atromaculatus*

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Minnow species which manipulate the stream substrate for spawning purposes, are often considered hosts to reproductive symbionts (nest associates). Two common species in the French Broad system of the Tennessee River drainage, *Nocomis micropogon* (River Chub) and *Semotilus atromaculatus* (Creek Chub), build large and distinct structures in the stream bed. Direct observations of high-color nest associate aggregations have led investigators to label both nest builders as hosts to *Notropis rubricroceus* (Saffron Shiner), while other data suggest closer spawning affinities between *N. rubricroceus* and *N. micropogon* than with *S. atromaculatus*. From 2005-2008, high-colored *N. rubricroceus* were observed over *N. micropogon* nests in South Fork Mills River, and only observed over *S. atromaculatus* nests in 2009. Eggs were collected from two nests of each putative host, and genotyped using RFLP of the mtDNA ND2 gene in order to positively identify species which actively deposit their eggs in these nests. *Nocomis micropogon* is host to four cyprinid species (*Notropis rubricroceus*, *N. leuciodus*, *Luxilus coccogenis*, and *Campostoma anomalum*), while *S. atromaculatus* does not appear to allow any associates to spawn in their nest site. Observations of high-colored nest associate species swarming around a nest site may lead to the erroneous conclusion that they are actively engaged in egg deposition. Behavioral characteristics of the two nest builders likely explains the observed difference in spawning assemblages.

Oral Presentation

Non-Cryptic Cryptic Species: Molecular Phylogeny Reveals Morphological Diversity in the Corrugated Darter, *Etheostoma basilare*

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The Corrugated Darter, *Etheostoma basilare*, is a complex of cryptic species that comprises at least five deeply divergent clades, each endemic to a different tributary of the Caney Fork River. An updated molecular phylogenetic analysis using mitochondrial and multiple nuclear genes supports the hypothesis that *E. basilare* comprises seven clades. This phylogeny was used as a guide to reassess morphological variation in the complex: meristic trait analyses on over 500 specimens were performed, and the results show that the species in the complex are not truly cryptic as each clade is morphologically distinct. This finding suggests that the formal description of six new species is warranted, and it highlights the great importance of a phylogenetic framework when considering species diversity and delimitation. As the Caney Fork River System is extremely small (approximately 6,700 square km), the finding also illuminates a very rare example of vertebrate microendemism in a temperate setting.

Oral Presentation (student competition)

The distribution and status of *Hybopsis amnis*: an analysis of drainage occupancy from historical records

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A total of 1094 *Hybopsis amnis* (pallid shiner) records, dating from 1891 to 2006, were compiled from data provided by 36 museums, universities, and government institutions. *H. amnis* records were grouped into 25 populations coinciding with the drainages of the Mississippi River basin and western Gulf Coast tributaries. From 1940 to 2006 successive three-year intervals were delineated to determine the presence or absence of the pallid shiner within each drainage. Based on the presence/absence data a frequency ratio of species occurrence for each drainage was calculated. The frequency ratios, pre-1979 and post-1979, for the drainages were compared to elucidate recent trends in *H. amnis* occurrence. *H. amnis* populations from eight of twelve pre-1979 drainages, with a frequency ratio less than 0.21, were absent from those drainages post-1979. Further evaluation of the frequency ratios of the drainages revealed five populations to be stable, eight populations potentially imperiled, and twelve populations imperiled. Overall, there has been a decline in the presence of *H. amnis* within its historical range. A watershed analysis of the drainages is in progress to determine possible reasons for the decline of this poorly known species.

Oral Presentation

A multiscale analysis of *Etheostoma* darter habitat in the Ohio River Basin

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In order to better understand niche differentiation among sympatric populations of *Etheostoma* darters and to aid in recovery efforts of Ohio listed species in this genus, we developed quantitative niche models for nine species using localities from agencies, museums and our own field investigations. Using CCA and GIS classifications of geologic factors at the regional scale, our models documented relationships between bedrock type, drift, stream order and the presence or absence of darter species. For example, widely distributed *E. nigrum* was found on all rock types, in all drift thicknesses, at all stream orders. In contrast, the range limited, state endangered *E. maculatum* showed a preference for highly erodible, fissile bedrock rock types (shale and siltstone), increasing depth of till and greater stream orders – three factors in juxtaposition to one another. Using CCA of over 800 samples taken by seine at 16 riffles in nine streams of both glaciated and unglaciated origins in the Ohio River drainage, we examined microhabitat relationships between species on axes of flow, depth, and substrate composition. Common species such as *E. blennioides* and *E. zonale* were associated with sand and gravel while rarer species such as *E. camurum* and *E. maculatum* were associated with cobble, higher flow and deeper segments. The strength of these relationships was more apparent for *E. camurum* and *E. maculatum* when only males were examined. Our results suggest the distribution of range-limited species is determined by specialized factors that can only be quantified at particular locations (substrate size and shape), while others (bedrock type) can be used to make predictions across an entire region. By quantifying these factors, we hope to assist in making more deterministic predictions about suitable streams and stream reaches for recovery efforts of threatened species.

Oral Presentation

The Southeast Aquatic Resources Partnership initial approach to aquatic habitat conservation and restoration

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The mission of the Southeast Aquatic Resources Partnership is to work with partners to protect, conserve, and restore aquatic resources including habitats throughout the Southeast, for the continuing benefit, use, and enjoyment of the American people. SARP was one of the first “Fish Habitat Partnerships” approved by the National Fish Habitat Board. Initiated in 2001 to address the myriad issues related to the management of aquatic resources in the southeastern United States, we anticipate that SARP will be one of the major vehicles through which funding associated with the National Fish Habitat Action Plan will be delivered for aquatic habitat improvement. Using the Southeast Aquatic Habitat Plan as a guide, 32 restoration, enhancement, or research projects have been funded since 2006. Lotic ecosystems comprise 46% of funded proposals, coastal ecosystems 25%, lentic ecosystems 12.5%, and spring ecosystems 3%. Current initiatives emphasize science and data, map analyses, and prioritization. Examples of funding opportunities, previously funded projects, and opportunities for future collaboration with the Southeast Fishes Council will be presented.

Oral Presentation (student competition)

Comparative phylogeography of *Etheostoma boschungii* and *E. tuscumbia*: assessing habitat preference and dispersal ability

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Spring dependent species often, but not always, exhibit low levels of dispersal, resulting in reduced gene flow and high levels of population structure. Disentangling whether historical isolation or life history strategy shaped the current patterns of genetic variation is often difficult. Comparative phylogeographical studies of sympatric, closely related species can reveal lineage-specific differences in dispersal ability. This study used nuclear and mitochondrial DNA to compare phylogeographical patterns in two spring dependent species, *Etheostoma boschungii* and *E. tuscumbia*, with nearly sympatric distributions in the lower bend of the Tennessee River. Despite their shared spring dependence and close phylogenetic relationship, the two species differed substantially in phylogeographic patterns. *Etheostoma boschungii* was highly structured, with reciprocally monophyletic groupings among major creek basins, while *E. tuscumbia* was mostly panmictic over the same area with evidence for recent, local genetic structure. The shallower phylogeographic structure within *E. tuscumbia* suggests higher dispersal ability compared to *E. boschungii*, an unexpected result given the putatively greater spring dependence of *E. tuscumbia*. We suggest that differences in dispersal ability are tied to life history differences between the species. The homing tendency of *Etheostoma boschungii* to specific, ephemeral breeding sites (spring seeps) has likely facilitated the present pattern of extreme genetic structure, neither of which is present in *E. tuscumbia*. These results indicate that spring endemism does not always lead to high levels of isolation and that homing tendency may have a profound impact on phylogeographic structure.

Oral Presentation (student competition)

Contaminant Concentration Analysis of Perry County, Missouri Cave Streams Utilized by Grotto Sculpin (*Cottus carolinae*)

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The presence and concentrations of selected chemical contaminants were assessed in five cave streams and resurgence springs within the large sinkhole plain of the Perryville Karst, Perry County, Missouri. The study sites represent areas of high cave biodiversity and are the only known habitat for the cavernicolous scorpaeniform fish, Grotto Sculpin (*Cottus carolinae*). A total of 38 chemicals were targeted a priori using two types of passive sampling devices, polar organic chemical integrative samplers (POCIS) and semi permeable membrane devices (SPMDs). Two rounds of samplers were deployed in spring of 2008 for periods lasting approximately 30 days. Samplers were deployed in tandem, providing a holistic assessment of both polar and nonpolar (SPMD) dissolved aquatic contaminants. Automated multiprobe sensors were also deployed alongside samplers to monitor physical and chemical conditions at the study sites. Chemicals accumulated by the samplers were extracted, purified, and analyzed using gas chromatography and mass spectrometry (GC/MS) in order to identify and quantify compounds of interest. A total of 20 compounds were quantified in the study, and these data were used to estimate time-weighted average (TWA) water concentrations. Triazine (25%) and organochlorine pesticides and their degradation products (20%) were the most commonly detected classes of chemicals, followed by chloroacetanilide pesticides (15%) and polycyclic aromatic hydrocarbons (PAHs) (10%). In all, TWA water concentrations for 11 chemicals originating primarily from agricultural sources were quantified in POCIS, along with nine additional chemicals in SPMDs. This assessment provides evidence of pervasive and widespread contamination of Grotto Sculpin habitat in the Central Perryville Karst by a mixture of bioaccumulative organic contaminants including two organochlorine insecticides found at levels exceeding national criteria for protection of aquatic life.

Oral Presentation

A multi-species petition to list southeastern aquatic and riparian species as threatened or endangered under the U.S. Endangered Species Act

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It is well recognized that the southeastern U.S. has one of the most diverse aquatic faunas in the world and that this fauna is experiencing a high rate of imperilment and extinction. To address this critical situation, the Center for Biological Diversity has identified 608 Southeastern U.S. aquatic and riparian species that may qualify for listing as threatened or endangered species under the U.S. Endangered Species Act (ESA) and is developing a petition to the U.S. Fish and Wildlife Service (FWS) to have these species protected. We identified species for petitioning based on an iterative process utilizing information from available databases and literature cataloging information on species' habitat preferences, status and threats. As we work through individual species accounts for the petition and find new information, species may be added to or removed from the petition. Since 2009, species have been listed under the ESA at the lowest rate in the 36-year history of the Act, with an average of only seven species listed per year. In the absence of the petition and at the current listing rate, few of the species we have identified will receive protection in the near future. Available information indicates that many if not most of these species are facing increased pressure from a growing human population, destructive agriculture, forestry and mining practices, increased demand for water, and an increasingly warmer, drier climate that is being driven by anthropogenic release of greenhouse gasses. Recognizing improved efficiencies in grouping species by geography, ecosystem, taxonomy, or other factors, FWS policy encourages listing of species in multiple species listing packages. In line with this policy, we seek to expedite federal protection for imperiled southeastern aquatic and riparian species to forestall their further decline or extinction.

Oral Presentation (student competition)

Shape differences in the blacktail shiner, *Cyprinella venusta*, associated with impoundment in the Mobile Basin, AL

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Phenotypic traits can evolve repeatedly when independent populations are exposed to similar environmental conditions. That fishes can exhibit morphological adaptations to natural flow regimes is well understood, but morphological change associated with anthropogenic changes in flow regime has not been investigated. We studied the association between morphology and impoundment in Mobile Basin populations of the blacktail shiner, *Cyprinella venusta*, collected from paired impounded and free-flowing stream sites (min. of 40 specimens per sampling site). Age of impoundment ranged from 29 to 36 years. Shape variables were extracted from 11 body landmarks and analyzed for significant shape variability using Procrustes methods. Significant shape variation existed between impoundment and stream populations, with individuals from impoundment populations exhibiting deeper bodies than those from stream populations. The investigation of differences in body shape associated with impoundment provides the basis for studies addressing the influence of stream flow on morphological and life-history traits in the blacktail shiner, including genetic variation in and heritability of the traits.

Oral Presentation (student competition)

Population ecology and habitat use of the invasive northern snakehead (*Channa argus*) near Brinkley, Arkansas

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The Northern Snakehead (*Channa argus*), a predatory species native to Asia, was discovered in the Big Piney Creek drainage near Brinkley, Arkansas in 2008. In March, 2009, Arkansas Game and Fish Commission and US Fish and Wildlife Service launched a large effort to eradicate the Northern Snakehead from an area of over 200 square kilometers using rotenone distributed by ground and air crews. University of Central Arkansas students collected fish community samples at 45 sites, 7 of which had Northern Snakeheads present. Snakeheads were also collected at 22 additional locations for a total abundance of 787 individuals. Snakehead density ranged from 0.002 to 0.02 individuals per square meter of stream and was not significantly different from the density of the ecologically similar native Bowfin (0.0086 bowfin/m², 0.01 snakehead/m²; $P=0.629$), suggesting niche overlap between the two species. A length frequency histogram revealed a stable, growing population with a large number of young-of-year and several adult age classes. Preliminary results suggest snakeheads are reproductively mature by age one and all females in the population are able to reproduce in a given year. Specimens were collected in all habitat types, except for areas of high flow in Big Piney Creek. Presence of Northern Snakeheads displays no correlations to biotic or abiotic conditions, suggesting the species was successfully dispersing throughout the Big Piney Creek drainage by March, 2009.

Oral Presentation

Status of nonindigenous red shiner (*Cyprinella lutrensis*) in the Coosa River, Alabama

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Red Shiner, (*Cyprinella lutrensis*) is a highly aggressive species that has been repeatedly introduced outside of its native range via baitbucket and aquarium release, and other mechanisms. This species now dominates degraded streams in the Chattahoochee River drainage near Atlanta, Georgia where it was introduced, in some areas comprising over 90% of species present. Hybrids/introgressed individuals between red shiner and congeners have been reported, all from areas where red shiners have made secondary contact or have been introduced into areas with native species (i.e., *Cyprinella venusta*, *Cyprinella camura*, *Cyprinella spiloptera*, *Cyprinella callitaenia*) and it is probable that red shiners will hybridize with additional species of *Cyprinella* if contact is made. In Alabama, the nonindigenous red shiner has been reported from sites in the Tombigbee, Chattahoochee and Coosa river drainages. In the Coosa River drainage, red shiner threaten the federally listed threatened blue shiner (*Cyprinella caerulea*) (high conservation concern, P2 in Alabama). Red shiner was reported in low numbers at sites in the Coosa River drainage, but recent data are lacking. This area is especially important to monitor due to the proximity to the smallest and possibly most endangered population of blue shiner in Alabama, in Spring Creek, Cherokee County. Our objective was to determine the current distribution and abundance of red shiner in Alabama relative to historical sites. We found red shiner/introgressed individuals at 10 of 40 sites surveyed. These individuals were often extremely abundant, and were distributed from the Georgia state line in Weiss reservoir to the mouth of Choccolocco Creek.

Oral Presentation

A biodiversity assessment for freshwater gastropods.

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North America contains the richest freshwater gastropod fauna on the planet. This diversity is organized into 13 families, 96 genera, and nearly 700 species described thus far. As with other riverine groups, zoogeographic patterns of species diversity are focused around major drainage basins. Although freshwater snails show exceptional diversity in areas outside the southeast, the Alabama River drainage is the epicenter of North American species richness. Endemism is exceptionally high in some families making many species vulnerable to extinction from localized impacts. An initial conservation assessment of the North American fauna determined 68 species of freshwater snails are likely Extinct (GX) and at least 352 additional species rank as Endangered or Threatened (G1 or G2), and another 68 species are considered Vulnerable (G3). Because 70% of currently recognized species are extinct, endangered, threatened, or vulnerable, this is the highest imperilment rate for any major freshwater group in North America, including freshwater mussels. However, only 26 species of freshwater snails are currently recognized by the US Fish and Wildlife Service as Threatened or Endangered. Within Alabama high species richness remains in several river basins across the state, including the Cahaba River (≈ 31 spp.), Limestone Creek (≈ 22 spp.), and the Paint Rock River (≈ 20 spp.). Definitive species records in Alabama, as with other states are difficult to determine because most basins have not been adequately surveyed. Conservation planning and on-the-ground recovery efforts with freshwater snails are underway in Alabama including an artificial propagation and culture program for some of the states rarest riverine snails.

Oral Presentation

A synopsis of the Southeast Aquatic Resources Partnership's comprehensive effort to assess the status of Southeast aquatic habitats.

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With input from state and federal fish and wildlife agencies throughout the 14-state Southeastern Aquatic Resources Partnership (SARP) region, the Southeast Aquatic Habitat Plan (SAHP) identifies eight critical habitat components to address: riparian zones, water quality, watershed connectivity, hydrologic integrity, sediment flows, physical habitat, invasive species, and coastal habitat condition. Each SAHP objective contains specific and measurable targets by which to evaluate conservation actions. To establish a baseline for habitat condition, provide the fundamental data required for developing SARP restoration priorities, and meet goals of the National Fish Habitat Action Plan, SARP has initiated a GIS-based spatial assessment of each of the 8 habitat components using best available data and scientific approaches. For demonstration we discuss our seminal effort to assess Objective 1- Riparian zone condition. These assessments will generate detailed data layers at fine spatial resolution (e.g. catchment, stream reach) that can be integrated to provide a unique and informed perspective of aquatic habitat condition at a variety of spatial scales. Data will be made available via ArcServer and other resources to widely support the research and conservation of Southeast fishes and their habitats.

Oral Presentation

Range contraction and relict populations: Genetic diversity in *Nothonotus chlorobranchius*, Greenfin Darter.

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There is more sequence divergence in the mitochondrial cytochrome *b* gene in *Nothonotus chlorobranchius*, Greenfin Darter, than in any other *Nothonotus* species. *Nothonotus chlorobranchius* inhabit only the upper portions of Tennessee River Drainage tributaries that flow over the Blue Ridge physiographic region, resulting in populations that are highly disjunct. Not surprisingly, there is a strong geographic signal in the genetic data, but populations from adjacent drainages are not necessarily sister lineages in the *cytb* phylogeny. The most notable instance of such a relationship is a sister relationship between the northern and southern most populations of *N. chlorobranchius*, from the Watauga River and Little Tennessee River respectively. We use estimates of historical population sizes to assess hypotheses of isolation and dispersal as mechanisms contributing to the observed phylogenetic pattern. Additionally, we compare patterns from previously published morphological analyses to the results of our genetic analyses and discuss the implications for taxonomic revision.

Oral Presentation

Breeding Coloration of Male *Cottus paulus* as Indicator of Body Condition

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Coloration is well studied in birds and fishes and is used for communication in many species. Most pigments must be acquired from the diet, therefore coloration may be used as an honest signal of condition. Higher quality males commonly have richer and more intense coloration therefore females may select which males to mate with based on these signals. Breeding male pygmy sculpin (*Cottus paulus*) exhibit relatively bright orange patches on their pectoral fins and body, and our objective was to investigate their use in mate choice in this species. These patches are positively correlated with body condition. However, coloration did not correlate with average eggs gained or average egg clutch gained over a set period of time. This unexpected relationship may be because other species of sculpin generally lack color except a thin, orange margin on the first dorsal fin and are nocturnal. Coloration in pygmy sculpin could not yet be defined as a trait linked to female choice, despite its association with body condition. Female *C. paulus* may prefer males in good condition and receive benefits such as effective brood defense, decreased filial cannibalism and fungal infections. The male breeding coloration makes them more susceptible to predation, the more intense the orange the more conspicuous and possibly the higher quality of mate a male is.

Oral Presentation (student competition)

**Movements and Habitat Use of a River Leviathan, Alligator Gar
(*Atractosteus spatula*)**

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The Fourche LaFave River of west-central Arkansas accommodates a viable population of alligator gar. The relatively unaltered status of the river allows recruitment by maintaining connectivity with spawning locations in the floodplain tributaries. The Fourche LaFave population is attractive as a model for the movements and habitat use of periodic fishes in a contiguous system. Over three trips (5 December 2008, 23 January and 2 February 2009), 27 adult alligator gar were captured with gill nets from a deep bend on the Fourche LaFave River and externally tagged with Advanced Telemetry Systems F2090B radio transmitters. They were also tagged with passive integrated transponder (PIT) tags and t-bar Floy tags. Blood samples and fin clips were taken for sexing and DNA analysis, respectively. Lengths (147.0 cm – 220.0 cm) and weights (25.0 kg – 82.0 kg) ranged widely. Tracking began January 2009 and will continue until the summer of 2010. Basic descriptive analyses reflect seasonal differences in macrohabitat use, particularly between the main channel of the river and its tributaries. Further tracking will add to a body of data describing movement patterns and habitat use and selection on various temporal scales. Microhabitat data have been collected throughout the project and use versus availability will be a strong focus during the remainder. Additionally, we will seek to analyze the patterns of movement from the larger space of the watershed into an identified over-wintering location. The majority of existing gar life history data are from lentic and estuarine populations; data describing riverine alligator gar are lacking. This study will produce needed data as well as providing direction for future studies and stewardship efforts in Arkansas and similar regions.

Oral Presentation

Nesting Biology, Chronology, and Hybridization Risks of the Rare Barrens Darter, *Etheostoma forbesi*

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The Barrens darter (*Etheostoma forbesi*) is a rare *Catnotus* darter endemic to the Caney Fork River system in middle Tennessee. Hybridization with the closely-related fringed darter (*E. crossopterygion*) has been assumed as a risk to the Barrens darter. In order to assess the chronology and similarity of nesting habitat between species, nests of each of these egg-clustering darters were monitored through two springtime nesting seasons in tributaries of the Caney Fork system. Thirty-nine Barrens darter nests were located at Duke Creek in Cannon County, and 28 fringed darter nests were found at Hickory Creek in Coffee County in 2008. Barrens darters used a smaller spawning surface area on nest rocks (mean = 239 cm²) than fringed darters (mean = 404 cm²), at shallower depths (mean = 19.6 cm vs. 23.8 cm), with higher mean stream flows above nest rocks (15 cm/sec vs. 8 cm/sec). Mean eggs per nest was higher for the Barrens darter (215-578 vs. 130-323), with a maximum egg count in a single nest of 1,992 for the Barrens darter and 925 eggs for the fringed darter. We continued the study in two additional streams during the 2009 spawning season and generally found similar trends. In summary, our results show distinct differences in nesting habitat use between the two species, suggesting a reduced risk of hybridization.

Oral Presentation

The darter Tree of Life: Inferences from mitochondrial and nuclear genes

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There are approximately 240 species of darters and to date there has been no comprehensive phylogenetic analysis that has included the majority of species in the clade. In this phylogenetic analysis more than 380 specimens were sampled from all darter species except *Etheostoma sellare*, *E. segrex*, *E. pottsii*, *E. lugoi*, and the Beaded Darter (*E. cf. stigmaeum*). A mitochondrial gene (cytochrome *b*) and two nuclear genes (RAG1 exon 3 and S7 intron 1) were sequenced for all of the sampled specimens. Separate Bayesian phylogenetic analyses of each gene as well as analysis of a concatenated dataset resulted in resolved darter phylogenies and most nodes were supported with significant Bayesian posterior probabilities. The phylogeny is used to illustrate a high rate of mitochondrial DNA introgression in darters and present a classification that is consistent with the inferred phylogenetic relationships. These phylogenetic hypotheses will provide a basis for a broad array of comparative studies that highlight macroevolutionary trends in darters.

Oral Presentation

Watershed assessment activities in the Big Canoe Creek Strategic Habitat Unit and rediscovery of the trispot darter, *Etheostoma trisella*, in Alabama

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Big Canoe Creek (Coosa River system) in Alabama is designated a Strategic Habitat Unit (SHU) for mussels in the Mobile River basin. Recent efforts to assess water quality and habitat, biological condition, and the status of greatest conservation need (GCN) aquatic species resulted in the discovery of a rare fish species. The trispot darter, *Etheostoma trisella*, was rediscovered in Little Canoe Creek in October 2008 after an absence in collections for over 50 years. The trispot darter had been officially considered extirpated from Alabama streams until this discovery. Over a 5-month period of sampling, 228 darters (92 males, 116 females, and 20 sex undetermined) were found at 13 out of 22 sites sampled. Two active breeding sites were discovered and sampling data suggested that the distribution of *E. trisella* in the Little Canoe Creek system is likely more widespread. Individuals were first collected in shallow shoals in Little Canoe Creek proper while conducting a biological assessment in October 2008. Additional individuals were found in main channel Little Canoe Creek—nonbreeding habitat—in November and December. Individuals were taken in small, perhaps ephemeral, tributaries to Little Canoe Creek—breeding habitat—beginning in late December. Individuals in varying degrees of nuptial preparedness were found throughout January while individuals with fully developed nuptial colors and gonads were found from early February to early March. By early April, breeding sites were uninhabited and only a few spent individuals were collected. Further surveys are planned for 2010 to refine the distribution of trispot darters in the Big Canoe Creek system and search other stream systems during the breeding season.

Oral Presentation

Temporal patterns of development in southern brook lamprey (*Ichthyomyzon gagei*) in Cadron Creek, Arkansas.

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Lampreys are one of the few living representatives of the ancient jawless fishes. Of the four species in Arkansas, three are nonparasitic, including Southern Brook Lamprey, *Ichthyomyzon gagei*. *Ichthyomyzon gagei* live for approximately 51 months and have a distinct larval and adult period. Subsequent to spawning, adults die due to loss of the digestive tract that occurs during adult transformation. Specimens were collected from September 2004 through April 2006 with a backpack electrofisher. We measured total body length, eye diameter and weight of the digestive tract, gonads, fat, and total body. Eye diameter increased significantly throughout the collection period in both metamorphosing and non-metamorphosing individuals. Metamorphosing individuals developed a significantly larger eye compared to non-metamorphosing individuals. Gonadal development began in November and gonadosomatic index (GSI) peaked in January and remained high through February. In metamorphosing individuals GSI was negatively correlated with both visceral fat ($r = -0.73$, $P < 0.001$) and digestive somatic index ($r = -0.72$, $P < 0.001$). Digestive tract mass of metamorphosing specimens decreased sharply during early (September to November) metamorphosis to a nonfunctional remnant and feeding ceased. As a result, energy stored as fat is utilized for the large energy requirements of gonad development. Based on our data, use of digestive somatic index may provide a mechanism for detecting transformers at an earlier date than previous studies. Due to the imperiled status of several species of lamprey, species determination at the ammocete phase is critical to both research and preservation efforts.

Oral Presentation (student competition)

Investigating palaeodrainage hypotheses for the Tennessee River using the *Etheostoma stigmaeum* species complex

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One of the first comprehensive assessments of the drainage history of the Tennessee River was given by Hayes and Campbell (1894). Their research suggested that during the Cretaceous through Tertiary, the upper Tennessee River was directly connected to the Coosa River of the Mobile basin via the Appalachian River. Subsequently, many researchers have noted a close affinity between fishes of the Tennessee and Mobile drainage basins; however, Hayes and Campbell (1894) further argue that during the Tertiary, the Sequatchie River crossed the state of Mississippi, flowing down the course of the Big Black River. In the late Tertiary, the Appalachian River was pirated by the upper Sequatchie which continued across Mississippi until it too was captured and turned northward creating the modern Tennessee River. The suggestion that the Tennessee once flowed across the state of Mississippi has been somewhat supported in the geological literature; however, this hypothesis has largely been ignored by biologists, and as a result, the phylogenetic relationships of the fishes of Mississippi to those of the Tennessee and Mobile drainages are unknown. To investigate this drainage hypothesis and assess the phylogenetic relationships of the fishes within the drainages of Mississippi to those of the neighboring Tennessee and Mobile basins, sequences of the mitochondrial cytochrome *b* gene were generated from specimens of the *Etheostoma stigmaeum* species complex collected in Kentucky, Tennessee, Alabama, and Mississippi and were used to infer phylogenetic relationships. If a portion of the Tennessee River once flowed across the state of Mississippi, it would be expected that the fishes of Mississippi would be more closely related to those of the Tennessee basin than to those of the neighboring Mobile basin.

Oral Presentation

Sound production in *Cyprinella lutrensis* – possible implications for hybridization

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Cyprinids of the genus *Cyprinella* are known to produce acoustic signals during the spawning season. These signals are composed of various spectral and temporal components which may evolve at varying rates and these are likely important for species recognition and mate choice. The well-known invasive *Cyprinella lutrensis*, the red shiner, produces sounds that consist of the knock and burst call types identified in other species of *Cyprinella*. Typically signals used to differentiate among conspecifics are expected to diverge rapidly in areas of sympatry with close relatives when there is a cost to making a mating mistake. However, when there is an invader it is possible that signal differentiation may not be as exaggerated. *Cyprinella lutrensis* is a species in the western clade of *Cyprinella* which generally produce simpler call types with fewer components than those in the eastern clade (*C. caerulea*, *C. trichroistia* and *C. gibbsi*). It is possible that errors in species recognition occur when female eastern *Cyprinella* mistake the more general signal characteristics of *C. lutrensis* as those of their own species. Future work will include a more thorough description of signals within *C. lutrensis* and conducting playbacks with other species.

Oral Presentation

Development of a strategic habitat plan for the Mobile River Basin

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In 2004, the U.S. Fish and Wildlife Service (USFWS) designated 26 river and stream segments (units) in the Mobile River Basin (MRB) (69 FR 40084) as critical habitat (CH) for eleven listed freshwater mussel species. The units encompass approximately 1,093 miles (1,760 kilometers) of the best remaining habitat in the MRB. These units also contain a major proportion of the MRB's other imperiled aquatic fauna including mussels, fishes, snails, and crayfish. In 2008, the USFWS in cooperation with the Alabama Aquatic Biodiversity Center (AABC) of the Alabama Department of Conservation and Natural Resources (ADCNR), the Geological Survey of Alabama (GSA), and the Alabama Clean Water Partnership (ACWP) initiated efforts to create strategic management opportunities for imperiled species in the MRB. This initiative has been and continues to be facilitated through the following activities: 1) Establishment of strategic habitat units (SHU) for each of the 26 CH units and mapping these areas using a Geographic Information System (GIS) database; 2) Development of SHU-specific watershed information database. For imperiled species management and recovery to proceed systematically with some reasonable expectation of success, watersheds must be understood from a biological, water quality, and land use perspective; 3) Using the SHU evaluation techniques to identify and prioritize stream reaches that need protection, management, or restoration; and 4) Development of an action plan for SHU. This involves a cooperative partnership of local landowners, local and county governments, local businesses and farmers, state and federal agencies, environmental organizations, and watershed partnerships.

Oral Presentation

Status and recovery efforts of the southern walleye in Alabama

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The southern walleye (*Sander* sp. cf. *S. vitreus*) is a genetically unique fish endemic to the Mobile River Basin in Alabama and Mississippi. In Alabama, southern walleye have been collected in the Alabama, Coosa, Cahaba, Tallapoosa, Black Warrior, Tombigbee, Mobile, and Tensaw river systems. In 2005, we began sampling to determine the current status of the southern walleye. Initial sampling efforts were directed in the Coosa River system then expanded to historical collection sites. We expended over 170 hours of electrofishing, 276 hours of gillnetting and 1,575 net/nights searching for southern walleye. Catch-per-unit of effort for southern walleye was 0.20fish/hr and 0.01fish/hr for electrofishing and gillnets, respectively. No walleye were collected in trapnets. Of the 52 specimens collected, 39 were genetically identified as southern walleye; all were collected from the Coosa River Basin. The remaining specimens were identified as either northern x southern walleye hybrids, northern walleye, or saugeye. These results indicate the decline in southern walleye and need for recovery efforts.

Oral Presentation

Reproductive Ecology and Captive Propagation of the Spotted Darter

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The spotted darter (*Etheostoma maculatum*) has a fragmented distribution range including one population restricted to the Elk River, WV. No previous study has documented life history characteristics of this population. Given conservation concerns regarding this small isolated population, we conducted a captive propagation study. Four spawning groups of the spotted darters set up in separate 20 gallon tanks in a larger 250 gallon recirculation system. Slates were positioned in the tanks as spawning cavities. Temperature was maintained by drawing in outside air. Natural photoperiod was achieved with an astronomic timer. Eggs were collected from nests (slates) during 29 April to 13 June within a water temperature range of 16C to 22C. Egg clusters ranged from 16 to 163 eggs deposited over a weeks time. The estimated total number of eggs spawned was 1169 with an average of 194 (range 116 to 211) eggs per female. Egg production differed among tanks with different spawning groups; a spawning group of two males and three female yielded 211 eggs, one male and two females produced an average of 128 eggs per female, and one male and one female produced 116 eggs. From a subsample, initial egg size ranged from 1.9-2.0 mm, and eggs at hatch were oblong with the short diameter of 2.0 mm and the long diameter of 2.2 mm. Egg survivorship was estimated at 61% (714 larvae from 1169 eggs), and larval survivorship was 72.4% (517 of 714 individuals). The initial larval size was approximately 6.75 mm. Data from this captive propagation study will be useful toward understanding the reproductive biology of the spotted darter, and will contribute toward conservation and management plans for the Elk River population.

Oral Presentation

Patterns of co-existence and hybridization between two topminnows (*Fundulus notatus* and *F. olivaceus*) across four coastal drainages

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Two ecologically similar topminnow species (*Fundulus notatus* and *F. olivaceus*) were studied in four contact zones in the Pascagoula (Mississippi), Pearl (Louisiana), Sabine and Neches (Texas) drainages. Within each contact zone, we sampled the full fish assemblage and measured a suite of environmental characteristics at 8-10 sites above, in the middle and below putative contact zones. All topminnows were genotyped to identify individuals of hybrid ancestry. The strength of ecological gradients in each contact zone was assessed via spatial autocorrelation of environmental (abiotic gradient) or community (biotic gradient) ordination variables with stream kilometer. We compared the abundance and distribution of parental species in the context of the strength of abiotic and biotic (spatial) ecological gradients in each contact zone. Ecological models were used to assign contact zone geographic structure to each system (disjunct, diffuse or mosaic).

Oral Presentation

Decades of water and habitat quality improvement resulting from the Tennessee Valley Authority's integrated operation of the Tennessee River system

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The TVA Act was initially established to provide for navigation, flood control, economic development, and generate electrical power. As a federal agency, the Endangered Species Act requires TVA to consult with the U.S. Fish and Wildlife Service on actions that could affect federally-listed species, including routine operation and maintenance activities at TVA's dams. However, in spite of the potential to affect a total of 29 federally-protected aquatic species (six fish and 23 mollusks) at 49 dams in seven southeastern states, consultation on TVA's dam operations resulted in the need to change operations to improve conditions for endangered species in three areas: Tims Ford Dam on the Elk River, dams in the Bear Creek system, and Wilson Dam on the mainstem Tennessee River. This is partly because TVA established minimum flows and commitment to meet minimum dissolved oxygen (DO) levels in releases from 16 dams. Since the early 1990's, TVA has spent about \$60 million to add equipment and change operations that will increase DO and provide minimum flows, resulting in dramatic improvements in DO over more than 300 miles of river and wetted habitat maintained over 180 miles of river previously impacted by intermittent drying. These improvements resulted in designation of Nonessential Experimental Population status for several federally-listed fish and mollusks in a mainstem river reach (Tennessee River downstream of Wilson Dam) and a tributary reach (French Broad River downstream of Douglas Dam). TVA's biological sampling has documented improvements, especially in warm tailwaters, but cold tailwaters have also improved.

Oral Presentation

Invasion of the Tennessee and lower Cumberland river systems by the inland silverside (*Menidia beryllina*) and its effect on brook silverside (*Labidesthes sicculus*) populations, with notes on other recent invaders to the Tennessee River system

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The inland silverside (*Menidia beryllina*) has invaded the mainstem Tennessee and lower Cumberland river systems from 1991 to present. In the Tennessee River system, individuals were first collected in Tennessee Valley Authority (TVA) fish samples from Kentucky Reservoir in 1991, Pickwick Reservoir in 1993, Wilson and Wheeler reservoirs in 1994, Guntersville Reservoir in 1998, Nickajack Reservoir in 2001, and Chickamauga, Watts Bar, Fort Loudon, and Tellico reservoirs in 2004. This species has been collected frequently in TVA samples since 1999 in the Cumberland River system from Barkley and Old Hickory reservoirs. Current data indicate that this invasion has occurred from the Ohio River rather than through the Tennessee-Tombigbee Waterway. Although more time is needed to fully understand the effect of the inland silverside invasion on native aquatic fauna in the Tennessee and Cumberland rivers, trends indicate that brook silversides (*Labidesthes sicculus*) are being affected by this invader. In most reservoirs where inland silversides have been established for more than seven years, brook silversides have become much less abundant. Striped mullet (*Mugil cephalus*) have been collected in Kentucky and Pickwick reservoirs in TVA samples during 2003 to 2008 and have presumably entered the Tennessee River from the Ohio River. Several invaders native to the Tombigbee River system have been detected in recent years in the Tennessee River system during TVA fish sampling. Atlantic needlefish (*Strongylura marina*) have been collected in Barkley, Pickwick, Wilson, Wheeler, Guntersville, and Chickamauga reservoirs during 2007 to 2009; blacktail shiners (*Cyprinella venusta*) have been documented in ten streams draining to Kentucky, Pickwick, and Wilson Reservoirs from TVA stream samples from 1987 to 2009; and weed shiners (*Notropis texanus*) have been collected from sixteen localities in fourteen streams draining to Pickwick Reservoir during TVA stream samples from 1998 to 2009.

Oral Presentation

The Fishes of Four Prairie Streams Across a Gradient of Urbanization.

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Many prairie fishes are notable for their high tolerance to harsh conditions and natural environmental disturbances. Previous work in urbanized prairie streams in central Oklahoma found no indication that species adapted to the harsh environment of the Great Plains were affected by urbanization. We examined headwater communities from twenty sites in four streams along a gradient of urbanization draining north-west Oklahoma City. As a secondary purpose we are describing the headwater fish faunas from three of the four streams. Our results indicated that disturbances from Oklahoma City are causing a strong effect on the communities. While three major cosmopolitan fish families showed no significant difference across streams, the minnow family Cyprinidae, were almost completely absent from urban headwater streams but common at all other sites. In addition, we report finding a previously common plains species, *Fundulus kansae*, the Northern Plains Killifish, from only 2 sites in the survey. We conclude both that these systems present a natural laboratory for ongoing urbanization in light of the continued and inevitable growth of Oklahoma City, and that further examination of these streams and the extirpation of cyprinids is warranted.

Oral Presentation

Habitat Utilization and Distribution of the Rush Darter, *Etheostoma phytophilium*, in Mill Creek and Wildcat/Doe Branches of Clear Creek in Winston County, Alabama

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A population distribution and habitat study of the Rush Darter, *Etheostoma phytophilium*, in the Mill Creek and Wildcat Branch tributaries to Clear Creek in Winston Co. AL was conducted between May 2006 and June 2008. During this survey it was determined that shallow wetland areas with dense stands of aquatic vegetation, (mainly rushes but with stands of sedges, cattails, grasses, watercress etc.) were the preferred habitat for this fish. However, it was also determined that, during the early spring months of February, March and April, some adult members of the upper Mill Creek and lower Wildcat Branch populations migrate into shallow, ephemeral channels and pools to spawn. Provided there is sufficient rain to prevent them from becoming trapped, these fish and their fry move back into the main creek channels in late spring where they seek refuge during the warm summer months in backwater seeps and spring runs in scattered clumps of bur reed (*Sparganium americanum*), other aquatic vegetation and submerged tree root masses.

Oral Presentation

Phylogenetic relationships and taxonomic status of native-strain walleye (*Sander sp. cf. vitreus*) from the Central Highlands and Mobile Basin

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Native populations of the walleye (*Sander sp. cf. vitreus*) persist in the Central Highlands and Mobile Basin despite the widespread destruction of their spawning sites and the introduction of exogenous fish. Although a few relictual spawning groups of native-strain walleyes are known, neither their relationships with other walleye populations nor their taxonomic status have been rigorously investigated. I used a combination of mitochondrial, nuclear, and microsatellite markers to assess the phylogenetic relationships of native-strain walleyes. Phylogenetic analysis of mitochondrial cytochrome *b* and nuclear RH2 sequences revealed three distinct lineages. The “Highlands walleye” was the basal-most lineage and included populations from the Cumberland River (KY), New River (VA), upper Ohio River (OH), and Black River (MO). The “southern walleye” (an endemic to the Mobile Basin) was the sister group to the “northern walleye” (*S. vitreus sensu stricto*). The combined data set supports the hypothesis that native-strain walleye from the Central Highlands and Mobile Basin are phylogenetically distinct and represent two separate and currently unrecognized species. Distribution of the Highlands walleye is consistent with historical records for *Stizostedion salmoneum* and warrants taxonomic recognition.

Oral Presentation

Freshwater Conservation Potential of Protected Areas in the Tennessee and Cumberland Basins

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According to the Millennium Ecosystem Assessment, about 12% of the world's inland water systems overlap with protected areas (PAs). However, the majority of these areas have not been designed nor designated to protect freshwater systems. Hydrologically-mediated stresses originating outside PAs, such as altered flows and water quality, can significantly limit the conservation potential of a given PA; yet freshwater gap assessments have not taken these dynamics into account. Newly available hydrologic datasets have made it possible to undertake analyses that begin to incorporate these dynamics. We conducted an initial assessment of the freshwater conservation potential of protected areas in the Tennessee and Cumberland Basins. Of the 297 PAs in our study region, about half do not cover an entire watershed and only 10 PAs encompass watersheds greater than 50 km² in size. The majority of PAs have low upstream imperviousness; only 17 catchments, totaling 0.2 % of the upstream area of PAs in the region, exceed the critical threshold of 10 % imperviousness. Unlike impervious cover, agricultural lands are prevalent upstream of PAs: 83 % of the upstream area that flows into PAs is covered by greater than 10 % agriculture. Additionally, about 20% of PAs have greater than 10 % of land within their boundaries under agriculture. Additionally, a survey of PA managers within the region documented the level of effort being expended on freshwater conservation on these lands and managers' perceptions about the major drivers of compromised aquatic integrity inside and outside of PAs. The results from the survey will be compared with those from the GIS-based analysis.

Oral Presentation

An overview of TVA contributions to the knowledge of southeastern fishes

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In 1986, TVA biologists began assessing the condition of streams and rivers in the Tennessee basin using Index of Biotic Integrity (IBI) methodology. Since then, approximately 900 streams have been surveyed, most on a 5-year rotational basis. The IBI method provides insight into the fish community structure and an estimate of fish relative abundance. Backpack electrofishing and seining are used to deplete species in wadable habitats (riffles, runs, pools, and shorelines) and boat mounted electrofishing units are used to sample deep pool habitat, if present. Data generated from IBI including species occurrences are largely unpublished, but is shared with state and federal government agencies and conservation groups. A recap of the discovery of new populations and range extensions of rare fish species, and documentation of non-native fish species occurrences will be discussed.

Oral Presentation

The Ichthyology Collection at the Yale Peabody Museum of Natural History

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Natural History collections at Yale began in 1802 with the Silliman collection. The Collection grew and in 1866 O. C. Marsh began the Yale Peabody Museum of Natural History. The Ichthyology collection increased significantly when the Bingham Oceanographic Collection formally became part of the Peabody Museum in the early 20th century. The early collection represented taxonomic diversity and was primarily marine in origin. In recent decades the collection has become a repository for fishes from diverse regions such as Atlantic Seamounts, Antarctica, and the Americas. Presently the fish collection includes specimen lots from 42 U.S. States, including the District of Columbia representing 1,238 taxa (including marine taxa). Since 2006 the collection has increased by nearly 50% (annual growth rate of over 2,000 specimen lots per year). Presently the Ichthyology collection at the museum contains over 22,195 specimen lots, 314 type specimen lots (more than 925 individuals of 191 nominal taxa), and over 17,500 tissue samples.

Oral Presentation (student competition)

Efficacy of *in situ* artificial refugia to increase recruitment of the Barrens topminnow in the presence of invasive western mosquitofish

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Rare species, already found in small populations or with limited distributions, may be particularly vulnerable to the added competition or mortality caused by an exotic species. The invasive western mosquitofish, *Gambusia affinis*, is implicated in the decline of a native fundulid species, the Barrens topminnow, *Fundulus julisia*. Artificial refuges hold promise as a management approach to promote coexistence of the Barrens topminnow and western mosquitofish because larval and juvenile topminnows appear to be the most vulnerable to negative impacts of mosquitofish. The primary goal of this study was to test the ability of refuges to increase topminnow recruitment in the presence of mosquitofish in the wild. Three categories were established to classify study sites: Experimental (sites where artificial refuges were deployed, and mosquitofish were present), Control (sites where artificial refuges were not deployed, and mosquitofish were present), or Reference (sites where artificial refuges were not deployed, and mosquitofish were not present). Two replicates were established for each category, yielding a total of six study sites. To assess topminnow recruitment, all six sites were sampled monthly for larval and juvenile topminnows (<32 mm TL) from June to August 2008 and then revisited by seining for juveniles in November and December 2008. Artificial refuges were deployed at the two Experimental sites in May 2008. During monthly light-trapping and tow-netting, larval and juvenile topminnows were collected at Experimental and Reference sites only, but we were unable to detect differences between categories. During fall seining, juvenile topminnows unexpectedly were collected in all three categories of sites, and we were unable to detect differences between categories. Juvenile topminnows were documented using the artificial refuges at both Experimental sites but we were unable to detect a clear preference for refuges over alternate available habitat. Small sample sizes and inadvertent stocking of captive-bred topminnows in some study sites likely contributed to the equivocal results of the study.

Poster Presentation (student competition)

Sturgeon bycatch in the Altamaha River shad fishery, Georgia

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Although the shortnose sturgeon (*Acipenser brevirostrum*) has been federally protected as an endangered species since 1967, incidental capture of shortnose sturgeon in commercial shad fisheries has been documented as a source of mortality that may limit recovery of some populations. As such, shortnose sturgeon bycatch assessments were recently identified as a priority by the National Marine Fisheries Service, as part of the iterative process of identifying and reducing threats to East Coast sturgeon. The objective of this study was to estimate total bycatch and mortality of shortnose sturgeon in the anchored gill net portion of the Altamaha River commercial shad fishery from 2007 - 09. Using a roving creel survey design, we conducted on-the-water counts of commercial shad nets to estimate fishing effort. Catch-per-unit effort was estimated from direct observations of net retrievals by randomly selected commercial fishermen. Over the 3 years of the study, total estimated bycatch of shortnose sturgeon was 65, 53, and 498 fish, respectively. Catch rates were highest during January and February of 2009 in upriver commercial nets near previously confirmed spawning locations in the river. Mortality of captured shortnose sturgeon was low in all three years (< 10%), although we did not assess post-release survival. Future studies are needed to better assess population level effects and sub-lethal effects of incidental capture on shortnose sturgeon.

Poster Presentation

Discordance among genes and the taxonomic implications for the minnow genus *Opsopoeodus* (Cyprinidae).

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The generic placement of the Pugnose Minnow, *Opsopoeodus emiliae* Hay (Cyprinidae) and thus, the validity of the monotypic genus *Opsopoeodus* have been debated in recent decades. In addition to *Opsopoeodus*, the Pugnose Minnow has been placed in the genus *Notropis* and most recently, based on cytochrome b data, in the genus *Pimephales*. Other studies have recognized *Opsopoeodus* as a valid genus that is closely related to *Pimephales*, *Codoma*, and *Cyprinella*. Mitochondrial and nuclear gene sequences were generated to further evaluate the validity of the genus *Opsopoeodus* and to determine its phylogenetic relationships to these other genera. Analysis of the mitochondrial and nuclear datasets resulted in different hypotheses of phylogenetic relationships among ingroup taxa and to potentially different taxonomic conclusions for the Pugnose Minnow. Despite discrepancies, relationships recovered from the nuclear data were well-resolved and consistent with previously published morphology and behavior studies that supported the recognition of *Opsopoeodus* as a valid genus. Although mitochondrial genes recovered each species as a strongly supported monophyletic clade, they provided little or no resolution of relationships among species or genera and showed high levels of saturation at inter-genus levels of divergence. These findings re-emphasize the importance of considering multiple datasets in making taxonomic decisions and caution against interpretation of single gene trees as species trees.

Poster Presentation (student competition)

A Temporal Study of Body Shape Change and Niche Position of Darters in the Pearl River

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The Pearl River system drains approximately 23,000km² in central Mississippi and eastern Louisiana. In the past 50 years, the Pearl River has seen human-induced modifications that have resulted in significant changes in the fish community. In particular, darters (Family Percidae) have been negatively impacted by these changes. Many species of darters co-occur in similar habitats, but ingest different prey items or occupy slightly different microhabitats, thereby allowing them to co-exist. Niche-partitioning has presumably allowed for high species richness and co-existence of darters in the Pearl River. More than twenty species of darters are known from the system, including the Pearl Darter, *Percina aurora*, which has not been collected in the drainage since the early 1970s. The purpose of this study was to use geometric morphometrics to analyze the degree of niche overlap among the darter species in the Pearl River and to examine temporal changes in niche position among the species as a result of the extinction of *P. aurora* in the Pearl River. We used body shape as a surrogate for niche-position, as it has been used in other studies. To date, specimens have been analyzed from Pools Bluff Sill from the 1960's-1980's. Preliminary results suggest that *P. aurora* is a generalist in terms of body shape, and that following the extinction of *P. aurora*, other species have filled in the niche formerly occupied by *P. aurora*.

Poster Presentation

Silent Streams: Current Extinction Rates of North American Freshwater Fishes

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Accelerated extinction rates are of fundamental interest to conservation science, and changes in extinction rates are critical metrics of faunal status and trends. In 1989, 40 species and subspecies of North American freshwater fishes were identified as extinct; that estimate was revised to 61 taxa in 2008. In the revised tally, five taxa were deleted from the 1989-list (one taxon is a synonym and four remain extant with endangered status), and 26 extinct taxa were added in 2008. Since 1989, extinct taxa have increased by 74%. The 61 extinct taxa include 36 species, 17 subspecies, 3 distinct populations, 2 ecological species, 2 undescribed species, and 1 undescribed subspecies. The range in estimated years of extinction is 1898 to 2006. Since 1890, the mean extinction rate is 5.5 taxa per decade. This rate greatly exceeds a widely cited published estimate of 2.4 extinct species per decade. Extinct taxa by family are Cyprinidae (18 taxa), Catostomidae (3), Ictaluridae (1), Salmonidae (9), Atherinopsidae (3), Goodeidae (6), Fundulidae (1), Cyprinodontidae (9), Poeciliidae (3), Gasterosteidae (2), Cottidae (1), Moronidae (1), Percidae (2), and Cichlidae (2). Human activities are directly or indirectly responsible for the extinctions of all missing North American freshwater fishes, predominantly through habitat alteration and loss and introduction of nonindigenous fishes. The two largest intrinsic attributes among extinct fishes are narrow endemism and lack of direct parental care. Attributes of species susceptible to near future extinction are endemism coupled with proximity to population centers, transportation corridors, precarious ecological settings, and vulnerability to introduced organisms.

Poster Presentation (student competition)

Feeding-related morphometrics of the blackstripe topminnow, *Fundulus notatus*

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The *Fundulus notatus* species complex consists of three described species: *F. notatus*, *F. olivaceus* and *F. euryzonus*. *F. notatus* and *F. olivaceus* have broad overlapping ranges with many populations being found both in and out of contact zones. Contact zones are generally found in mid reaches with *F. olivaceus* dominating headwaters and *F. notatus* larger rivers downstream. Both species share similar ecological niches so the mechanism allowing for stable coexistence in contact zones is unknown. The purpose of this study was to examine variability in feeding morphology of both species in sympatry and allopatry across three drainages. Both *Fundulus* were sampled in Pascagoula River, Pearl River and Neches River contact zones in the summer of 2008. As a control for plastic effects, both *Fundulus* were reared in sympatry and allopatry in common garden mesocosms. Fish were genotyped and feeding-related morphometrics were taken (standard length, body width, body depth, head length, head width, head depth, interorbital distance, preorbital length, orbit length, postorbital length, gape width, gape height, premaxillary + maxillary length and dentary length). Feeding-related morphometrics were analyzed to determine if there were ontogenetic shifts or sexual dimorphisms in allopatric and sympatric populations. Analyses were also conducted to determine if there were differences among species and sympatric/allopatric populations.

Poster Presentation (student competition)

Adaptive Cluster Sampling Designs for Estimating Abundance of the Tuxedo Darter *Etheostoma lemniscatum*

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The tuxedo darter *Etheostoma lemniscatum* is a rare, federally endangered fish found in Tennessee and Kentucky with only one extant population remaining in the Cumberland River watershed. Adaptive cluster sampling (ACS) designs were tested to determine if they could be implemented as a sampling protocol for monitoring this species. Baseline data was collected at sites on the Big South Fork of the Cumberland River in order to simulate the efficiency of various ACS designs. Five ACS designs were chosen from simulation models and tested at 13 sites in the river. ACS designs performed better than simple random sampling designs, providing estimates with small confidence interval widths. Estimates of total tuxedo darter population size were ~200 individuals with about 90% of tuxedo darters located at five sites within a range of 7 km. ACS protocol efficiency increased with effort and therefore, a trade-off exists between sampling effort and accuracy of estimating population size. An unrestricted ACS design is recommended because it has small error but also requires less effort than other protocols. This study was the first to implement adaptive cluster sampling for a rare and endangered stream-dwelling fish, and results indicate that this may be a potential method for consideration when monitoring habitat-specific, stream fishes such as the tuxedo darter.

Poster Presentation

A community-based approach to setting conservation goals and objectives for multiple fish species on the Cumberland Plateau in Tennessee

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The Cumberland Mountains and Plateau Region in northern Tennessee are home to rich natural resources and biodiversity. Resource extraction and development continues to expose terrestrial and aquatic species to a variety of threats. We are currently developing two Habitat Conservation Plans to address the potential effects of forest management activities and commercial/residential development on more than 40 threatened species in the Cumberlands, including 11 fish species (eight percids, three cyprinids). We will provide an example of how agency biologists and university scientists recently formed a team to work with species experts, foresters, and land managers to generate biological goals, objectives, and conservation measures for the target species. In the forestry HCP, for example, we are using several fish species as “umbrella species” to protect key biotic communities in Cumberland Plateau aquatic habitats. We will describe the process and criteria we used to choose umbrella species and how the fish-species attributes are being used to generate conservation measures.

Poster Presentation (student competition)

Evidence of a source-sink population of shortnose sturgeon in the Altamaha and Ogeechee rivers, Georgia

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The Ogeechee River, Georgia is thought to contain one of the smallest populations of the endangered shortnose sturgeon (*Acipenser brevirostrum*). The objectives of this study were to: 1) estimate population abundance, 2) evaluate seasonal habitat use, and 3) evaluate seasonal changes in habitat suitability based on established environmental tolerances of shortnose sturgeon. From June–August 2007–2009, we conducted a mark-recapture population estimate of the shortnose sturgeon population inhabiting the tidally-influenced portion of the Ogeechee River. To evaluate seasonal habitat use, we used ultrasonic-telemetry to monitor the weekly movements of 18 adults. Over the 3 years of the study we estimated the population to contain 235 to 368 (95% CL: 99–745) individuals. Telemetry data showed that during summer, freshwater habitats were preferred; however in cooler months, most fish moved into brackish water habitats in the lower estuary. Habitat suitability models for 2008 showed that habitat quality declined from 100% suitable in May, to only 28% marginal and 72% unsuitable by August. The lack of suitable habitat observed during the summer months provides further evidence that shortnose sturgeon in the Ogeechee are not a distinct population, but a sink to the source population of the Altamaha River.

Poster Presentation (student competition)

Assessing the impacts of Pools Bluff Sill on fishes in the Pearl River (1988-2009)

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Anthropogenic stream impoundments are regular occurrences across most drainages of the Southeastern United States. Despite the commonality of these perturbations, studies exploring the effects of impoundments on the abundances and movements of fishes are relatively low in numbers, and are stream system specific. The Pearl River, a Gulf coastal drainage of Louisiana and Mississippi, is no stranger to stream impoundments, containing two modifications (Pools Bluff Sill and Ross Barnett Dam) within its basin. The low head dam, Pools Bluff Sill, was constructed in the early 1950's near Bogalusa Louisiana, in order to maintain a navigable water level in a manmade shipping channel. Although some water passage is permitted across the sill, there is great concern that the sill may inhibit upstream movement of some fishes. In this study we utilize data collected from multiple sites in the Pearl River between 1988 and 2009. We examined the impacts of Pools Bluff Sill as a barrier to different ecological groups of fishes (*i.e.* non-benthic generalists, benthic specialists, etc.), in order to determine how species specific abundances relate to spatial dynamics of the Pearl River. Our results suggest that species most greatly impacted by the sill presence were benthic specialists, which possessed very high abundances below the sill (N=1 site) as compared to all above sill sites (N=15 sites). Non-benthic generalists were not as strongly affected, usually maintaining comparative abundances both above and below the sill. Implications of our results and possible actions for conservation will be further discussed.

Poster Presentation (student competition)

Life History of the Northern Snakehead in the Southeastern United States.

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The Northern Snakehead, *Channa argus*, is a highly invasive species that was recently discovered in eastern Arkansas. Given the high fecundity, early maturation and diet preferences of this species in its native range, there is a strong impetus for understanding life history traits of the Northern Snakehead in Arkansas. Approximately 800 individual snakeheads were collected in March 2009 from a large-scale rotenone event conducted by Arkansas Game and Fish Commission in the Big Piney drainage near Brinkley, Arkansas. Fish were preserved in 10% formalin and brought to the laboratory where a total of 479 snakeheads were dissected and gonads separated. Standard and total length were taken for each fish as well as total body mass, eviscerated mass, and gonad mass. A positive correlation between standard length (SL) and total length (TL) was found for both sexes ($r = 0.98$) and there was no significant difference in condition between females and males using ANCOVA. The observed sex ratio (1.1F:1M) was not significantly different from a 1:1 ratio (Chi-square test, $P = 0.25$). Individuals with discernable gonads were found for all individuals greater than 15 mm TL, indicating reproduction is occurring in some individuals at Age 1. Mean gonadosomatic index (GSI) was 1.29 ± 0.05 SE for females and 0.14 ± 0.05 SE for males. There was a significant correlation between GSI and SL in females ($r = 0.69$). Our data suggest reproduction in the population of Northern Snakeheads in Arkansas may be occurring at an earlier age than previously reported (typically Age 2 or 3). Continued research will allow us to determine the effect of the 2009 rotenone event on the life history characteristics of the Northern Snakehead.

Poster Presentation

Mark-recapture study of *Fundulus olivaceus*, blackspotted minnow, to analysis movement in Big Creek

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The restricted movement paradigm (RMP) states that adult fish in a stream have restricted movements within a small pool. Although most studies find that fish are sedentary, small numbers of fish are recorded moving out of the area of the first capture suggesting that individuals within a fish populations exhibit either a restricted movement pattern or travel throughout the stream. Such behaviors may relate to fish responding to disturbances in stream dynamics and possibly are exploring new habitats for colonization. Currently, little is known about the home range and individual movement of the blackspotted topminnow, *Fundulus olivaceus*. We used elastomer tags to individually mark 144 *F. olivaceus* in Big Creek, a small tributary in the Pascagoula River drainage. A total of 73 fish were recaptured over twelve weekly surveys. 43 fish were recaptured once, 17 recaptured twice, and 13 captured three or more times. Of the 73 recaptures, all but 3 were within 50 m of the original release point. Daily movement rates were less than 1.5 m per day and not biased by sex or direction (up vs. down stream). We used the Jolly-Serber method to model population size and survivorship.

Poster Presentation

Preliminary electrofishing surveys of urban and rural streams of the Flint River Watershed

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The Flint River Watershed is in a rapidly urbanizing area in North Alabama that is recovering from an exceptional two-year drought. Backpack electrofishing surveys were conducted in the upper, wadeable reaches in 2009 as part of a larger body of research examining the effects of urbanization and drought recovery in the Flint River Watershed. Fish community metrics such as richness, percent suckers, percent sunfish, and percent darters were used as indices of biological integrity of urbanizing versus rural stream reaches. Preliminary results indicate that rapidly urbanizing streams in the Flint River Watershed have impaired fish faunas in terms of diversity, community composition, and relative abundance. Also, during our electrofishing surveys, we collected species that are not represented in museum collections for the Flint River Watershed or that have very sparse and sporadic records for the Flint River Watershed. Therefore, we believe that our electrofishing survey may represent one of the most comprehensive surveys of the Flint River Watershed in recent times.

Poster Presentation

Coexistence of Banded and Pygmy Sculpin in Coldwater Spring outflow, Alabama

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Pygmy Sculpin (*Cottus paulus*) are only found in Coldwater Spring (Coosa River drainage) and the spring outflow. The species is found in diminishing numbers from the spring weir downstream for approximately 0.5 km., where they co-exist with Banded Sculpin and other species of fishes not found in the spring. As Banded Sculpin are approximately four times larger than Pygmy Sculpin and predaceous, we investigated predation potential and habitat overlap of these two species in the spring outflow. We found fish remains in 18% of Banded Sculpin stomachs examined, including one entire Pygmy sculpin. This suggests that the larger Banded Sculpin do prey on the smaller species, but that they are not a significant part of their diet, at least during the summer months. We found very little habitat overlap between the two species, with the larger Banded Sculpin found in deeper water with higher water velocities. It is possible that the two species have different activity periods, with Banded Sculpin being nocturnal and Pygmy Sculpin diurnal, but we were not able to confirm this.

Poster presentation

Population viability of Cape Fear shiners

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An empirically based population model and projection matrix was assembled for Cape Fear shiners using field count data and laboratory estimates of fecundity from captive females. Field counts were obtained from the Rocky River, Chatham County, North Carolina over three years during the same season (2007-2009). Elasticity analysis suggests that larval stage survivorship has the largest impact on population persistence. This result was further illustrated by population projections using variable numbers of adult Cape Fear shiners, which were remarkably similar. In all three projections populations of Cape Fear shiner numbers went below pseudo extinction in approximately 68% of the simulations. This suggests that the number of adults has very little effect on population growth, and conservation measures such as adult stocking programs would be ineffectual relative to improvement of larval survivorship and recruitment.

Poster Presentation

Design and Implementation of the Louisiana Fish and Wildlife Conservation Network (LFCWN) an information system for conservation planning in the State of Louisiana

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The Louisiana Fish and Wildlife Conservation Network (LFWCN) is a computer information system for Fish and Wildlife conservation planning in Louisiana. The objectives were to create a prototype portal for assembling data from natural history collections and databases of Louisiana conservation agencies, displaying the data on digital maps, analyzing temporal trends in occurrence and abundance of species, modeling critical habitat, using the results to monitor species conservation status, identify threats, and plan conservation action when needed. Fourteen Louisiana fish species of concern were selected from the Louisiana Natural Heritage Program's list of animal species of concern to test the utility of the portal. The species were *Acipenser oxyrinchus desotoi*, *Scaphirhynchus albus*, *Polyodon spathula*, *Alosa alabamae*, *Campostoma anomalum*, *Notropis boops*, *Notropis potteri*, *Notropis sabiniae*, *Phenacobius mirabilis*, *Cyprinella camura*, *Cyprinella whipplei*, *Pteronotropis hubbsi*, *Pteronotropis signipinnis*, *Pteronotropis welaka*, *Ericymba buccata*, *Cycleptus elongatus*, *Cycleptus meridionalis*, *Moxostoma carinatum*, *Noturus munitus*, *Fundulus euryzonus*, *Syngnathus scovelli*, *Crystallaria asprella*, *Ammocrypta clara*, *Etheostoma caeruleum*, *Percina lenticula*, *Percina macrolepida*, *Percina aurora*, *Percina coplandi*. We analyzed temporal abundance trends for each of these species, modeled critical habitat within the state, and prepared species profile pages to increase awareness of each species' current conservation status.

Poster Presentation

An Overview of the Southeastern Louisiana University Vertebrate Museum

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The Southeastern Louisiana University Vertebrate Museum possesses specimens of fishes, amphibians, reptiles, birds, and mammals. The bulk of the collections are composed of fishes, with the majority of specimens from the Lake Pontchartrain Basin in southeast Louisiana, and more recently specimens from throughout Mexico. The collections are heavily used in both teaching and research. Internal and external research use of the SLU Vertebrate Museum has increased significantly in recent years and should continue to increase as our databases are made available online. With six vertebrate-research oriented faculty on staff and multiple vertebrate oriented graduate students, it is anticipated that the collections will continue to grow in the coming years. In addition to specimens, the museum possesses substantial tissue samples of specimens from throughout the United States and Mexico. The purpose of this poster is to introduce significant holdings of the SLU Vertebrate Museum, to enhance the attention to and use of these collections.

Poster Presentation

DNA Barcoding a museum's tissue collection recovers unanticipated diversity in the Fieryblack Shiner, *Cyprinella pyrrhomelas* (Cope, 1870).

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Caroline E. Kennedy, University of North Carolina, Chapel Hill, undergraduate, (cekenned@email.unc.edu)

The Fieryblack Shiner, *Cyprinella pyrrhomelas*, is among the most strikingly colored of the Carolina endemic fishes. Though very little has been published on the biology of the species, various studies have addressed its phylogenetic placement. During the summer of 2009, we noted NCSM's tissue collection had good geographic coverage of the species, so a rapid population level genetic survey using DNA barcoding techniques was performed. Surprisingly, we recovered high levels of genetic divergence between samples taken from Catawba drainage in NC and those taken from the rest of its range (the Broad, Pee Dee, and Saluda drainages in NC and SC). Refining the dataset by adding representatives of other *Cyprinella* taxa has provided compelling evidence for the introgression event hypothesized by Broughton and Gold involving *C. labrosa*. Interestingly, another introgression event appears to have been recovered involving *C. chloristia*. This secondary event divides the Catawba populations into "upper" and "lower" basin clades not unlike those previously reported for populations of *Notropis chlorocephalus*. Additional data will be required to substantiate these claims of mitochondrial introgression. Nonetheless, it appears that significant differences might exist to diagnose previously unrecognized diversity in *C. pyrrhomelas*.

Poster Presentation

Where did it go? A look into practical temperature data logger modifications for the real world.

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Economical innovations are a hallmark of ecological studies. Scientific equipment is notoriously expensive and researchers are always looking for ways to save money on supplies. Recent technological innovations have led to smaller, less expensive, data loggers, yet waterproof housings remain costly. We deployed loggers in a large-scale study examining the effects of small dams on Alabama streams. Initially, temperature logger housings were large and may have contributed to high loss rates. To reduce housing profile and displacement likelihood, we developed a new deployment/recovery system. We constructed economical, low profile temperature logger housings for use with iButton (Maxim Integrated Products) style data loggers. Materials used in housing construction include: one 6 in. black cable tie, one $\frac{3}{4}$ inch PVC Schedule 40 threaded plug, one $\frac{3}{4}$ inch PVC Schedule 40 threaded cap and one iButton temperature logger. Holes drilled below the head of the plug allowed placement of a cable tie through the plug head. The iButton was placed inside the cap and a water proofing sealant was added to the plug threads before the plug and cap were tightly screwed together. We employed several techniques to maximize logger retrieval success, which included highly visible marking systems, highly selective deployment locations within the stream, and waterproof digital cameras to document the logger localities. During the second logger deployment, we attained an 87.5% recovery rate compared to an initial recovery rate of 62.5%. Data recovery was 100% for this system and no loggers were damaged. The cost per housing was ~\$2.00, compared to the manufacturer's housing which retail at ~\$32.00 each. Our economical housing design should allow for greater logger deployment and recovery rates in aquatic studies.

Poster Presentation (student competition)

Bioassessment of a recently restored headwater stream in Rowan County, Kentucky

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Stream restoration is increasing as a method to repair streams damaged by anthropogenic activities. Biological monitoring is critical to measure the effectiveness of these restorations. In 2004, the Rowan County Road Department, Kentucky, constructed a road through the valley of Laurel Creek, severely impacting 716 meters of the headwater stream. Stream restoration, with the goals of restoring the contours and vegetation of the riparian area, occurred in Fall 2008. The objective of this study is to compare the biological community of fish and aquatic macroinvertebrates in Laurel Creek before and after restoration. Sampling was conducted above, within, and below the restored area using Kentucky Division of Water standard bioassessment protocols. Sampling occurred in June 2008 prior to restoration and after restoration in June 2009. Within and below the restored reach, fish abundance and biomass decreased after restoration in comparison to sites above the restoration. Relative abundance and diversity of aquatic macroinvertebrates increased at all sampling sites between 2008 and 2009, including the intolerant orders of Ephemeroptera, Plecoptera, and Trichoptera. Other factors may have contributed to these results, such as precipitation differences and construction activity related to the restoration.

Poster Presentation

Mate Preference and Association Behavior of Two Closely Related Topminnow Species *Fundulus notatus* and *F. olivaceus*

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Fundulus notatus and *F. olivaceus* are two species of topminnows that occupy largely overlapping North American ranges including the Mississippi River and Gulf of Mexico drainages, and are occupants of similar ecological niches. These closely related fishes appear phenotypically very similar, with the primary phenotypic difference being presence or absence of spots along their dorsal surfaces. The species are capable of interbreeding and hybridization and backcrossing has been documented in nature to a limited extent. However, studies of laboratory no-choice crosses have demonstrated that prezygotic isolation contributes to reproductive isolation. The goal of this study is to test the strength of conspecific mate preference as a mechanism of prezygotic isolation in both males and females. In separate experiments conducted in outdoor pools we have analyzed mate preference of these species using 1) genetic identification of offspring parentage when either males or females are presented with a choice of conspecific or heterospecific mates and 2) behavioral analysis of association preferences of single individuals when presented with a choice of potential conspecific and heterospecific mates isolated in viewing chambers. Genetic analysis demonstrated that females of both species exhibited a strong conspecific mate preference while males showed no such preference. Behavioral analyses suggested females exhibit a strong preference to associate with conspecific as opposed to heterospecific males while males associated more frequently with other conspecific males as well as conspecific females. Taken together, these studies provide evidence that prezygotic isolating mechanisms serve an important role in genetic isolation between these species.

Poster Presentation (student competition)

Distribution and Ecology of *Thoburnia atripinnis* (Bailey), the Blackfin Sucker (Cypriniformes: Catostomidae), in the Upper Barren River, Kentucky

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The highly distinctive catostomid, *Thoburnia atripinnis*, blackfin sucker, is hypothesized to be a relict species related to *T. hamiltoni*, rustyside sucker, and *T. rhothoeca*, torrent sucker, where it may have speciated after dispersal of ancestral stock from glacial events of the Teays River. The blackfin sucker, is endemic to the priority conservation area of the Upper Barren River drainage of Kentucky and Tennessee, spanning 4 counties in Kentucky. Due to its endemic distribution, low historic abundance and human induced impacts, the blackfin sucker is considered a “species of greatest conservation need” by the Kentucky Department of Fish and Wildlife Resources. Current data on distribution and conservation needs of blackfin suckers in the Upper Barren River is lacking, thus, the purpose of this study is to update this information, with emphasis on changes from historic distribution. At present, 16 sites have been sampled for blackfin suckers, including 13 historic sites, provided by Kentucky State Nature Preserves, previously holding records of blackfin suckers. A total of 10 families and 46 species, comprised of 5,320 individuals have been collected with only 13 blackfin suckers (0.2%) found at 4 sites. Blackfin suckers were typically found in low flow runs (<1 m/s), rocky pools and streams 5 to 10 meters in width. Adults were almost always captured in habitats that contained undercut bedrock crevices or large flat rocks. All young-of-year suckers were found in one riffle composed of primarily large gravel. Sampling is still ongoing, but low numbers of blackfin suckers discovered thus far are cause for concern.

Poster Presentation

Benthic Trawling as a Supplement to Electrofishing on the Ohio River

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ORSANCO has been monitoring fish populations of the Ohio River since 1957 using lockchamber rotenone surveys. In the early 1990's the primary sampling technique was switched to boat-mounted electrofishing. While we have considered electrofishing to be the best single method for assessing fish communities of the river, the deployment of a secondary method to sample aspects of the community not captured by electrofishing has been considered. From 2006 through 2008, benthic trawling was conducted at 166 electrofishing zones to determine the utility of this method as a secondary collection technique to better characterize fish populations of the Ohio River. Four, one to two minute trawls were conducted at each 500 meter electrofishing transect at specified depths and at various segments of the transect. An 8' wide otter trawl was used for all sampling. Overall, 664 trawls were conducted, of which fish were collected in 51% (340). While average time spent trawling at each 500 meter transect was comparable to time spent electrofishing (~45 min), electrofishing returned many more individuals (40,201 to 3012) and species (77 to 33). Trawling did, however, regularly capture species either not observed at all (eight species), or not observed in high numbers (e.g., *Percina spp.*, *Etheostoma spp.*), in the electrofishing data. Therefore, although trawling will likely not be incorporated into ORSANCO's routine monitoring and assessment efforts, the technique should be used regularly to monitor those components of the fish community not captured by rotenone and electrofishing surveys.

Poster Presentation (student competition)

Environmental Influences on Movement Patterns for Two Cyprinids in an Intermittent Reach of an Ozark Stream

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Spatial ecologists have long recognized that habitat connectivity and patchiness are essential features influencing a species' distribution. However, less is known regarding the factors that influence a species' movement response in complex environments. Despite the breadth of research on movement of small stream fishes, few studies have associated movement patterns with stream dynamics such as variable flow, habitat persistence, and habitat complexity. Additionally, no study has examined the implications of fish movement on population dynamics in a mid-reach drying stream (section upstream and downstream spring fed with middle section containing isolated pools). Therefore, the objective in this study was to determine environmental factors that may influence population level movement patterns of two fishes, southern redbelly dace (*Chrosomus euythrogaster*) and creek chub (*Semotilus atromaculatus*), in a mid-reach drying stream. In order to examine movement dynamics, a mark-recapture study using pool specific batch tagging will be employed. Prior to tagging, pools were sampled to determine if pool volume or distance from permanent water source influences fish abundances. Preliminary data analysis indicates a moderate significant correlation exists between total fish abundance and pool volume ($r = 0.66$; $P < 0.001$), while a weak correlation was found with distance from closest permanent water source ($r = -.38$; $P = 0.07$). Our initial analyses suggests abundance of fishes persisting in a pool are more dependent on habitat size rather than distance from a permanent water source. Future analyses will relate important environmental parameters with (1) species specific directional movement patterns, (2) distances moved and (3) persistence of a species.

Poster Presentation

Redescription of *Labidesthes vanhyningi* Bean and Reid based on morphological data

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Labidesthes Cope 1870 is a monotypic genus currently occupied by *L. sicculus* (Cope 1865). A second species, *L. vanhyningi*, was described from Florida by Bean and Reid in 1930, but was later placed in the synonymy of *L. sicculus* by Bailey et al. (1954) when they found meristic characters, putatively diagnostic for *L. vanhyningi*, in populations of *Labidesthes* from Arkansas. Examination of 533 specimens from localities across the range of *Labidesthes* (500 alcohol for meristic and morphological data, and 33 cleared and stained specimens for osteological data) resulted in four characters useful in diagnosing the species. *Labidesthes vanhyningi* is herein diagnosed from *L. sicculus* by having a pelvic girdle situated more anteriorly on the body, a more angular premaxilla, a more reduced anterolateral process of the post-temporal, and a midlateral stripe becoming broader and more diffuse anterior of the first dorsal fin.

Poster Presentation (student competition)

Relationship Among Stream Discharge, pH and Fish Abundance in Three Headwater Streams in Southeastern Kentucky

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Acidification of headwater streams in southeastern Kentucky is common due to high elevations, small watersheds and poor acid-neutralizing geology. Decreases in pH can impact small fishes, and thus lower species richness and diversity in these streams. Relationships among stream discharge, pH and fish abundance in three headwater streams, Bad Branch, Martin's Fork and Sugar Run, in southeastern Kentucky were investigated during a one year seasonal study. Data collection is still ongoing, but thus far a total of 403 individual fishes has been captured, including eight species, in five families. Linear regressions between seasonal data (spring and summer) of stream discharge and pH yielded significant results for Sugar Run ($p=0.0067$, $f=11.59$, $r^2=0.537$) during the spring and significant results for Bad Branch ($p=0.0166$, $f=0.0073$, $r^2=0.453$) during the summer. However, there was no significant relationship between pH and fish abundance within all three study streams for the spring and summer data. Kentucky Index of Biotic Integrity scores ranged from very poor in Martin's Fork during the spring, to fair quality in Sugar Run during the spring. Microhabitat usage of *Etheostoma sagitta sagitta*, a species of greatest conservation need in Kentucky, was also described in Martin's Fork during the spring and summer seasons.

Poster Presentation

Aquatic Species Conservation in the Mobile River Basin - The North River Strategic Habitat Unit

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In 2004, the U.S. Fish and Wildlife Service (USFWS) designated 26 river and stream segments in the Mobile River Basin as critical habitat for threatened and endangered mussel species. Strategic Habitat Units (SHUs) were established for each critical habitat segment. The North River SHU, located in the Black Warrior Basin of western Alabama, is home to several threatened and endangered species, including *Hamiota perovalis* and *Pleurobema furvum*. Mussel surveys performed in 1991 and 2008 indicate the number of mussel species found in the North River SHU has declined. Causes for this decline have been investigated by the Geological Survey of Alabama (GSA), and include detrimental changes in stream habitat quality, water quality, and land cover. A stream habitat evaluation revealed sediment bedload to be a significant nonpoint source pollution in the North River system, particularly in the Clear Creek watershed. Land cover change was analyzed in the North River watershed from 1974 – 2007, and results show a 32 % increase in impermeable surface area. Impermeable surfaces, prone to high rates of runoff, include land uses such as cultivation, urban development, and mining. Along with sediment impairment, water quality investigations reveal high levels of *E. coli* in various parts of the watershed. Nutrients are flushed down through the watershed, eventually reaching Lake Tuscaloosa, which has now become eutrophic. Recovery and restoration of imperiled aquatic species in the North River watershed will require a cooperative effort among landowners, resource agencies, and government institutions. To remove the North River from the 303(d) list, best management practices such as riparian buffers will be needed, along with an additional water quality investigation to determine nutrient loadings throughout the watershed.

Poster presentation (student competition)

Distribution and abundance of the rare Barrens darter, *Etheostoma forbesi*

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The Barrens Plateau region of middle Tennessee harbors a number of unique and endemic aquatic species, including the Barrens darter (*Etheostoma forbesi*). During June – October of 2009, we sampled 42, 100-m reaches in 30 streams for Barrens darters using backpack electrofishing. The sampling goal was to document the current distribution and abundance of the Barrens darter at most known historical collection localities and at additional localities within their potential range on the Barrens Plateau. Historical localities were chosen based on the collection records presented in Madison (1995) and Hansen et al. (2006). Peterson mark-recapture experiments were conducted at three reaches to facilitate population estimates and to determine efficiency of electrofishing gear. Specimen identification was verified with DNA sequencing of the nuclear S7 intron and RFLP analysis of mitochondrial cyt b. For RFLP analysis, mitochondrial cyt b was PCR amplified and then digested with the restriction enzyme BSA1. *Etheostoma forbesi* has a BSA1 site, whereas *E. crossopteron* does not, and the digests were run out on a gel for visualization of the banding pattern. We found Barrens darters present at 6 of 42 reaches in 5 of 30 streams. Raw abundance of Barrens darters ranged from 1 to 11 individuals (median = 5) at the 6 occupied reaches. Our survey results to date are consistent with previous surveys that highlight the limited distribution and rarity of this species. Next steps in our research include identifying environmental variables associated with Barrens darter presence at multiple spatial scales.